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A New Procedure for Urban Transportation Planning

Appendix to
Report
on the First Cycle
of a Research Project
for the Department of Highways, Ontario

De Leuw, Cather & Company of Canada Limited
October 1970



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J. STEFAN DUPRE

✓
A NEW PROCEDURE

FOR URBAN TRANSPORTATION PLANNING

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REPORT

ON THE FIRST CYCLE - Urban Development Process.

OF A RESEARCH PROJECT

FOR THE DEPARTMENT OF HIGHWAYS, ONTARIO

DE LEUW, CATHER & COMPANY OF CANADA LIMITED

OCTOBER 1970



A NEW PERSPECTIVE
ON URBAN TRANSPORTATION PLANNING



APPENDIX TO
REPORT
ON THE FIRST CYCLE
OF A RESEARCH PROJECT
FOR THE DEPARTMENT OF HIGHWAYS, ONTARIO



BY MAIL, CATHIE E. CORRY & COMPANY
OCTOBER 1970

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APPENDIX A

APPENDIX A-1
NOTES ON A METHOD OF DETERMINING BOUNDARIES
OF COMMUNITIES AND ACTIVITY AREAS

A neighbourhood could be defined as an area or district in which the residents have similar social and economic characteristics.

Identifying neighbourhoods can assist a planner in understanding the way in which people use their city. In effect, an attempt is made to chart something which has no validity except suggestively to a lot of people. To do this, it is necessary to try to define edges and centres of neighbourhoods some of which do not have clear-cut boundaries, centres or locations, but do have valuable patterns associated with them. Some of the steps that should be considered are:

Acquire basic information and compile all base data on a topographic map of the area.

Note the topography of the area - railroad lines, major traffic arteries.... Abrupt changes in topography are clues to the boundaries of the neighbourhood.

Study growth and the history of the city to indicate boundaries that are mostly historic.

Plot the development patterns as well as possible and these will indicate the centres of old developments.

Note the patterns of the streets and houses - they are clues to the ages of the development.

Obtain historical information from those in the city who take pride in their knowledge of the history of the area.

Structure, form and conduct informant interviews to determine what people know.

Ask questions of knowledgeable people.

Pose the right questions to the right people (real estate men, developers).

Ask people what they know about their city. People tend to structure in their minds the city in which they live and these things cannot be determined statistically. When the name of a place is indicated, record it on a base map.

Determine how people know each other, how they communicate. It may be by race, national groups, by income or by something else.

Identify areas of significant social and economic characteristics (e.g. prestige).

Determine ethnic and other cultural patterns noting that cultural patterns are not necessarily tied to a geographical area.

Note migration patterns.

Conduct resident interviews.

Ask people about the neighbourhood. The person being questioned will indicate general areas. Ask:

what do they call the area? (record on base map)

what do they call the next area? (record).

what is the difference between the two?

Look for what people regard as neighbourhoods. Public school districts or planning districts may define a neighbourhood but only if this has formed a pattern

of living in the minds of the people living in the area.

Source: Discussions with Lois Dean, Social Analyst.

APPENDIX A-2
NOTES ON AVAILABLE SOURCES OF INFORMATION
ON THE HISTORY AND GROWTH OF AN URBAN AREA

A telephone conversation was held with Ray Corelli who had written a historical series in the Toronto Daily Star on "The Toronto that Used to Be". His observations are helpful for obtaining historical data.

To study the growth and the history of a city, contact clearing houses of information such as:

- Welfare
- Churches
- Local politicians
- Railway records
- Private and non-profit organizations, such
as Bureau of Municipal Research in Toronto
- City Hall archives
- Harbour Authorities

Note that the street system is a clue to the extent and age of a special area.

Resident interviews should be conducted with people who have lived or worked for a long time in specific areas. The study of the older employment and recreation areas gives an indication of historical and recreational travel patterns. (This could lead to a better understanding of present patterns and possible trends in the future).

A pattern begins to emerge when all the information from all these sources has been collected and assembled.

Source: Ray Corelli, Reporter, Toronto Daily Star.

APPENDIX A-3

NOTES ON THE ELEMENTS OF AN URBAN AREA

An urban area can be separated in basic components that develop its physical form and provide for the perception of the physical city.

The basic elements are as follows:

1. Paths - major and minor circulation routes
2. Edges - constrictions or boundaries
3. Districts - areas of common identifiable character
(Communities - employment and activity areas)
4. Nodes - centres of activity
4. Landmarks - prominent visual features

Transportation systems have either a direct or indirect influence on all the elements listed above. They can amplify or reinforce the elements or they can diminish them. The effect can be actual or apparent and will greatly affect the attitudes and well-being of the inhabitants.

By definition, transportation systems are paths which will direct and shape everyday activities.

Transportation systems can be impermeable to local interaction and therefore will act as barriers or edges. An elevated system if massive, will appear to be a barrier and will limit the surrounding activities.

Districts are the basic units of an urban area and are generally united or enveloped by transportation systems. Sometimes they are clustered around transportation links.

Nodes as centres of activity are quite often the result of converging transportation systems.

The transportation systems enable many landmarks to be seen and also may themselves form landmarks, for example, bridges.

Planning begins with an appreciation of what we have. Therefore, one of the initial steps involved in planning an urban environment is to conduct an inventory of assets. This investigation will include:

- a) visual and physical form studies of the
 five components of an urban area
- b) geological and topographic studies
- c) flora and fauna studies
- d) sociological studies
- e) urban form studies
- f) historical studies

In these investigations the desirable and undesirable features will be identified.

Paths

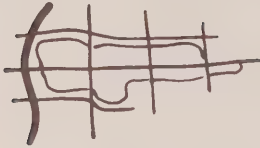
Paths can be characterized by pattern, mode and intensity. The type of features that are desirable will depend on the scale of the urban area that is considered.

- neighbourhoods
- districts
- city
- region

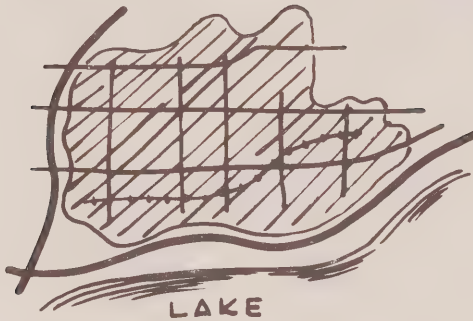
In general, for the larger areas the paths are more widely spaced and have greater intensities.



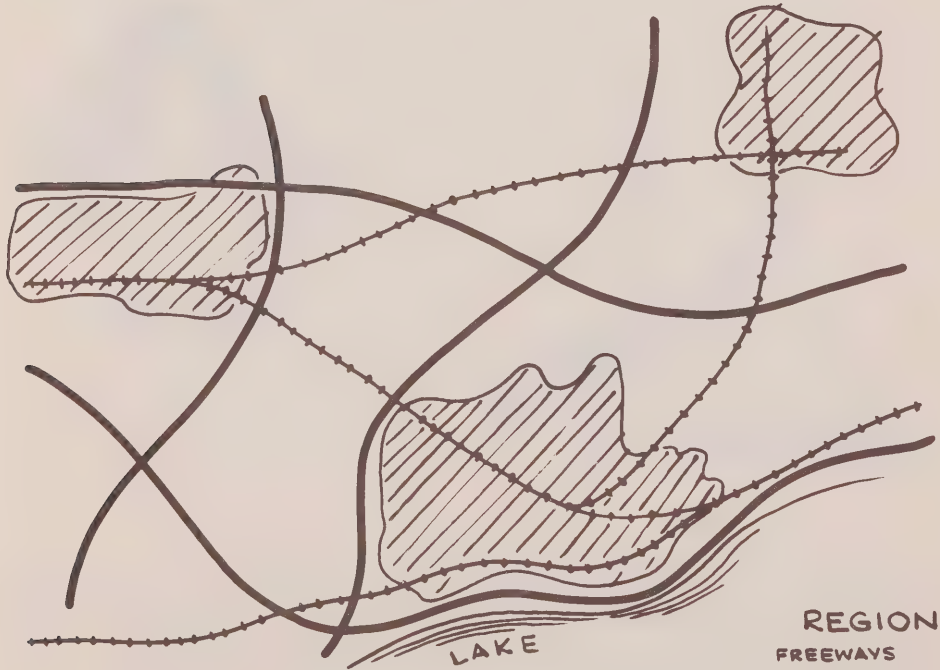
NEIGHBOURHOOD
LOCAL STREETS



DISTRICT
COLLECTORS
MINOR MASS TRANSIT



CITY
FREEWAYS
ARTERIALS
MAJOR MASS TRANSIT



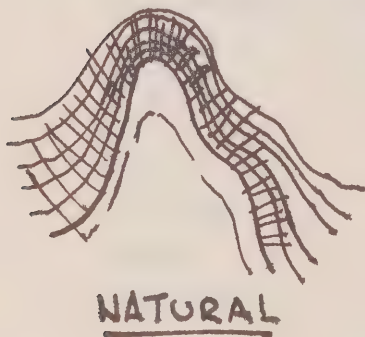
REGION
FREEWAYS
MAJOR HIGHWAYS
COMMUTER RAILROAD

The mode will depend on the size of the area and the density of development. There is a definite interrelationship between the different types of paths.

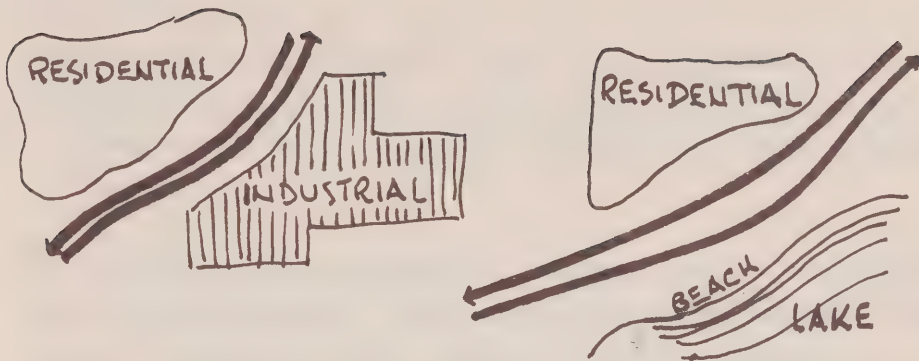
Freeways, arterials	- regional mass transit
Arterials, collectors	- major mass transit
Collectors	- minor mass transit
Local Roads	- pedestrian traffic

Edges

Edges are boundaries and can be actual or apparent, natural features or man-made.



Edges can be desirable or undesirable features. They can accentuate or define an area or they can isolate and restrict development. The type of desirable edges again will depend on the scale of the urban area and on the type of land use. Edges can be used as separators between incompatible land uses.



Districts

Districts are the basic components of an urban area. The following aspects have to be considered.

1. Form, density, character, patterns of urban space
2. Activity
3. Features
4. Paths
5. Centres
6. Intrusions
7. Change
8. Improvement

Districts are areas of common identifiable character. They are also in a state of change - either expanding or contracting. It is important to permit desirable change by the use of transportation facilities.

Nodes

Nodes are strategic locations at which activities are concentrated. Quite often they are decision areas. Clarity and orientation are of great importance at these points.

Landmarks

Landmarks are reference points. They can be references for the historical development and also for the travel in an urban area. A landmark may provide a goal for a trip and also indicate progress of travel.

Circulation influences growth form of modern cities. Few elements have had more influence. The interrelation of all elements, trade centres, residential areas, industrial areas are dependent on circulation. Fully coordinated planning and design of transportation facilities have great potential for improving our cities.

Source: Notes by Peter J. Jaunzems based on Reference 79.
Lynch, Kevin, "The Image of the City" Massachusetts
Institute of Technology Press, Cambridge, Massachusetts,
1960.

APPENDIX A-4

EXAMPLE: ORGANIZATION OF STUDY AREAS FOR METROPOLITAN TORONTO

The following drawings indicate how the City of Metropolitan Toronto could be organized along the lines suggested in Appendices A-1 to A-3. They are:

1. Base Plan Page 5

Work was carried out on overlays of a 1" = 2000' scale base plan.

2. Residential Neighbourhoods Page 6

These areas were laid out from personal knowledge of the city, limited interviewing, and recognition of the natural and man-made barriers in the city. Time budget limitations did not allow for more than cursory interviews.

3. Migration Patterns Page 7

Time and budget restrictions limited this part of the study to those ethnic migration patterns that are generally known by most residents in the city. Italians have tended to settle initially around College Street ("little Italy") and as they raise their status, they appear to have moved to the north along Keele Street and towards a former large public recreational area called Italian Gardens. It appears that the attraction of the regional parks in the Albion Hills is exerting this same kind of influence today.

The Jewish migration in Toronto generally starts from the Kensington Area. As a family becomes more prosperous, they tend to migrate northward along Bathurst Street and later may jump south to the prestigious Forest Hill district in central Toronto.

There are probably other more subtle migration patterns that could be determined with further study.

Knowing these social patterns can assist a designer in understanding the associated travel patterns for work, business and pleasure.

In carrying out an interdisciplinary transportation planning study, a social analyst would be able to ascertain whether or not these patterns could continue and form part of the future regional activity framework.

4. Residential Communities Page 8

The communities were made up of neighbourhoods that have similar characteristics and represent areas that form identifiable entities in the minds of those living there.

5. Residential Quality Page 9

This drawing shows the rank of desirable living areas.

6. Employment Areas Page 10

The areas outlined on this map are the major employment areas in the city, the employment included in the forty-three areas represents 90% of the total employment in the Metropolitan area. These areas are numbered as a '100' series.

7. Activity Centres Page 11

This drawing shows major areas of business, shopping, and recreational activity of which the central business district is the largest. It includes many tourist attractions, nightclubs and theatres such as:

Massey Hall
St. Lawrence Hall
St. Lawrence Centre for the Performing Arts
O'Keefe Centre
The "Royal Alex" Theatre
The Art Gallery
Maple Leaf Gardens
Ryerson Institute
The St. Lawrence Market
The Toronto Dominion Centre
The Union Station
City Hall
China Town
Royal Ontario Museum
McLaughlin Planetarium

Casa Loma, Upper Canada College and other smaller centres are not shown. These major activity centres are numbered as a '200' series.

8. Existing Open Space Page 12

Plotting the private and public parks in a city as well as the open space within the developed area is the initial step in the design of a long-range regional open space framework.

9. Census Tracts Page 13

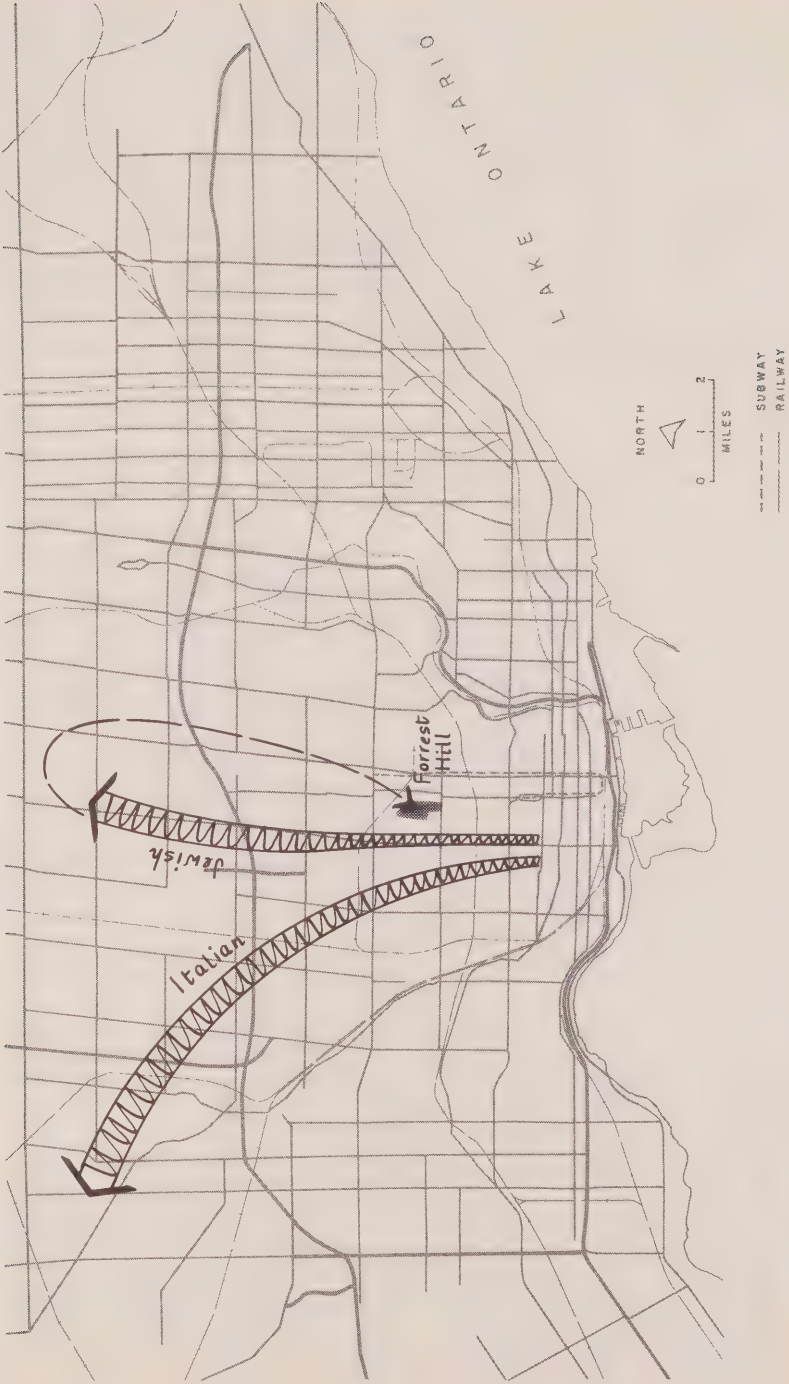
Population and labour force distributions were obtained from census data published by the Dominion Bureau of Statistics in Bulletin CT-15, Toronto. This publication lists population and housing characteristics by census tract which was then related to real residential communities.

If the employment (the work end of the work trip) could be tabulated for census tracts using classifications identical to those used for the labour force, it would not be necessary to have others make such tabulations specifically for transportation studies. The information given by census tract could be compiled for the major employment areas similar to way labour force and employment was compiled and recorded on this project for the residential communities.





NEIGHBOURHOODS



MIGRATION PATTERNS

RESIDENTIAL AREAS

1. Upper C.B.D.	32. North Toronto	63. West Hill
2. St. James	33. Leaside	64. Highland Creek
3. Regent Park	34. Thorncliffe Park	65.
4. Moss Park	35. Flemington Park	66.
5. Cabbage Town	36. Victoria Village	67. Pine Hills
6.	37.	68. Treverton Park
7. Kensington	38.	69.
8.	39. Downsview	70.
9. Parkdale	40. Wilson Heights	71. Scarborough Junction
10. The Junction	41.	72.
11. West Toronto	42. Yonge Boulevard	73. Scarborough Bluffs
12.	43.	74. Guildwood Village
13.	44. North Bayview	75. Thistletown
14. Rosedale	45. The Bridlepath	76. Rexdale
15. The Danforth	46.	77. Etobicoke
16. East Toronto	47. Don Mills	78. Briarcrest
17. The Beaches	48. Don Mills Fringe	79. Markland Woods
18. High Point	49. North Bathurst	80. West Deane Park
19. Swansea	50. Newton Brook	81. St. George
20. Babypoint	51. Willowdale	82. Edenbridge
21. High Park	52. Bayview Village	83. Islington
22. Old Weston Road	53.	84. Lambton Mills
23. York	54. Henry Farm	85. North Kingsway
24. Cedarvale	55. Don Valley Village	86.
25. Forest Hill Fringe	56. Wishing Well Acres	87. South Kingsway
26. Forest Hill	57. Agincourt	88. The Queensway
27. Deer Park	58.	89. Park Lawn
28. Moore Park	59. Wexford	90. Alderwood
29. East York	60.	91. Long Branch
30. Weston	61.	92. New Toronto
31. North York	62. Orton Park	93. Mimico



RESIDENTIAL COMMUNITIES



EMPLOYMENT AREAS

101. Central Business District	116. West Road	130. York Mills
102. Queen Street East	117. North York or "Caledonia Road"	131. Don Mills
103.	118. Eglinton Avenue West	132. Railside Drive Industrial Area
104. The Waterfront	119. Yonge - Eglinton	133. Golden Mile & Eglinton Square Shopping Centres
105. The Garment District	120. Leaside	134. Scarborough Junction Industrial Area
106. Parkdale Industrial Area	121. Bermondsey Road - O'Connor Drive	135. Golden Mile Industrial Area
107. Queen Street West	122. Highway 400	136.
108. College Street	123. Keele - Finch	137. Cedarbrae Shopping Centre
109. Bloor Street West	124. Downsview	138. Rexdale
110. Yonge - St. Clair	125. Yorkdale Shopping Centre	139. Toronto International Airport
111. The Danforth	126. Avenue Road North	140. Dundas Street West
112. East Toronto Industrial Area	127. Yonge Street	141. The Platinum Strip
113. The Junction	128. North Yonge Street	142. New Toronto, Mimico
114. West Toronto	129. Oriole	143. Toronto Island
115. St. Clair Avenue West.		



EMPLOYMENT AREAS

ACTIVITY CENTRES

201. Central Business District	217. Riverdale Park	232. Golden Mile & Eglinton Square Shopping Centres
202. Queen Street East Shopping Area	218. The Don Valley	233. Highland Creek Park
203. Greenwood Racetrack	219. Taylor Creek Park	234. Centennial College of Applied Arts & Technology
204. Toronto Island Park	220. The Danforth Shopping Area	235. Colonel Danforth Area
205. Island Airport	221. High Park	236. Marie Curtis Park
206. Canadian National Exhibition	222. The Humber Valley	237. Dundas Street - Cloverdale Shopping Area
207. Old Fort York	223. Dundas Street Shopping Area	238. Toronto International Airport
208. Queen Street West Shopping Area	224. Weston Road	239. Woodbine Racetrack
209. College Street and Kensington or "Jewish" Market	225. Eglinton Avenue West	240. Pioneer Village
210. Bloor Street West Shopping Area	226. St. Clair Avenue West	241. York University - Keele Street Campus
211. University of Toronto	227. Yonge - Eglinton	242. Downsview Airport
212. Government of Ontario Buildings	228. Alexander Muir Memorial Gardens	243. Yorkdale Shopping Centre
213. Yorkville	229. York University - Glendon Campus	244. Avenue Road
214. Yonge Street	230. Edwards Gardens, Wilket Creek and Serena Gundy Parks	245. Yonge Street
215. Allan Gardens	231. Don Mills Shopping Centre.	246. North Yonge Street
216. Riverdale Zoo		247. Don Valley Golf Course.



ACTIVITY CENTRES



OPEN SPACE



CENSUS TRACTS

APPENDIX B

APPENDIX B-1

CORRELATION BETWEEN CITY AND TRANSPORTATION PLANNING

Urban Planning

Organization

a) Design Team

- . City Planner
- . Transportation Planner (Engineer)
- . Landscape Architect
- . Architect

b) Consultation From

- . Sociologists
- . Economists
- . Ecologists
- . Political Scientists

Principles

Districts

Land-use compatibility

Intensity relationships

"Human Scale" (a situation in which a person is comfortable)

Maximization of opportunity - choice.

Procedures (Tools)

Nomographs

Visual presentations

Charts.

Methods

Defining districts, etc., as outlined in Appendix A.

Description of Relationship between City Planning and Transportation Planning

City planning encompasses a number of functions and includes:

Generic Planning

It utilizes rational selection to determine a course of action.

Profession

City planning has developed a body of knowledge or principles and practices self-control to uphold public and private interests. It has an ethical code. City planners are not licensed but will be in the near future.

Design Field

City planning can be thought of as a design field and has been associated with architecture, landscape architecture and law.

Public Policy

City planning is comprehensive in its approach and shapes public policy.

Government Activity

It is part of the executive government and legislature defines its terms.

The general plan is possibly the instrument used most often by city planners for determining and carrying out policy. The information included in the general plan varies from one municipality to another but generally includes:

Land-use, population density and intensity.

Housing.

Circulation.

Therefore the transportation system is an integral part of the city planner's scope. In the past transportation planning has been done independently, usually by consultants, and if accepted their recommendations are included in the general plan. The basis for a future transportation plan has been a future land-use plan which has normally been considered inflexible. In most cases the land-use plan is very general and may actually represent desired development rather than probable development.

The recommended method is to do both city planning and transportation planning simultaneously. The effect of one on the other can be determined, evaluated and, if necessary, modified to provide a better mutual solution.

Source: Discussions with R.L. Hart, City Planner.

APPENDIX B-2

NOTES ON FEATURES THAT SHOULD BE CONSIDERED IN PLANNING

A transportation corridor framework is only one of several planning frameworks in an urban area and the transportation framework must be coordinated with the others.

An intensive investigation has been carried out in the Western States bordering the Great Lakes to identify the assets in these areas and then provide or recommend some means for their preservation. Considerable success has been achieved in identifying conservation corridors and in private and public recognition of their importance.

Conservation Corridors

1. Identifying assets for conservation and recreational corridors:

- . Timber resources (watershed replenishment, economic assets, recreational)
- . Topographic features (ridges, valleys, etc., focal points; observation areas, identify slopes 25% and steeper)
- . Water (streams, rivers and lakes, as water supply and recreational assets, identify types of shore lines - what use best served)
- . Potential reservoir areas (reserve areas for future reservoirs to supply urban growth)
- . Wildlife reserves
- . Farmlands
- . Ecological balance of the area.

2. Miscellaneous Controls:

- . Soil conditions
- . Mineral deposits
- . Subsurface patterns (e.g. equifes recharge areas)
- . Fire hazard areas - high texture of vegetation
- . Flood plains
- . Fault lines
- . Dust
- . Disease vector patterns
- . Weather patterns (e.g. snow belt)
- . Sand and gravel areas
- . Archeology

3. Man-made features or conditions:

- . Urbanized areas
- . Noise
- . Odor
- . Waste patterns
- . Utility corridors
- . Transportation patterns

4. Items of importance to local residents - economic, cultural, historical, sentimental, etc., over 200 individual different items were identifiable from interviews with local residents.

The information listed above was plotted on overlays and the composite resulting pattern produced conservation corridors with special

"pockets of interest" forming nodes along the corridors. This is the basis for the design of a major statewide open space framework. After the corridors have been established the remaining areas are the ones designated in which future urban development can take place.

Implementation

The implementation for conserving the assets is one of the most important aspects of the project. Success was achieved mainly because:

1. Conviction of the principles involved regarding the validity of their proposal.
2. A direct approach in presenting the case to the people, politicians, etc., a "horse sense" approach was used rather than a technical approach.
3. Availability of state and federal funds for the project. (\$50,000,000 was obtained from a 1¢ increase in the cigarette tax.)
4. Understanding and personal involvement in the project by a large group of people by taking part in identifying items of importance in the local areas.
5. Resources both in manpower (students, etc.) and funds were also available through the University of Wisconsin.

Revitalization of Urban Areas

An effort is being made to improve a part of Gary, Indiana which is a heavy industry city with intensive pollution problems. The Calumet River area is being slowly transformed into an active recreational centre. This has been possible by the nationwide pollution control legislation and cooperation from industry.

New Tools for Conducting Inventories

The present methods for making inventories include air photography and research on the ground. It is hoped that satellites would be of great value in decreasing the costs and the time required to make the inventories. Using the satellites, updating the inventories could also be easily made, which is an important part of the project.

Some Comments by Mr. Lewis on Transportation Corridors

The most important driver experience is diversity. Judgement has to be exercised in the extent of diversity that is provided. It was suggested that a physiologist or a psychologist may be able to supply answers.

Space is three dimensional and the position of the facility in the space is as important as the design of the facility itself. Harmony and contrast have to be used to the best advantage.

Sources: 75. Lewis, Philip. "The Corridor as a Concept of Design and Planning", Highway Research Board Record Number 166, 1967.

76. Lewis, Philip H., Jr. and Associates. "Regional Design For Human Impact", Thomas Publications, Kaukauna, Wisconsin.

Notes by Peter J. Jaunzems on lecture by Philip Lewis, author of Regional Design for Human Impact.

APPENDIX B-3
NOTES ON THE URBAN DEVELOPMENT PROCESS

The urban development process is a continuous, always changing interplay of public and private funding actions and public policies. The monies, spent on construction of facilities for transportation, recreation, education, utilities and services and public buildings form a framework, a web of capital expenditures, which influences decisions on investment and construction. In addition, there are public controls and regulations, bylaws, taxes and fiscal planning that also influence the private sector. Tools used by city planners to guide urban development and some of the issues that may affect the urban development process are outlined below.

Urban Planning Tools

1. Government Spending - The Capital Web
 - a) Transportation
 - b) Recreation (Parks)
 - c) Educational Facilities
 - d) Government Buildings
2. Public Policy
 - a) Bylaws (Zoning)
 - b) Fiscal Planning
3. Influence of Government Spending and Public Policy on Private Development

Issues (and principles)

Economic

- Increase revenue to provide better services and standard of living
- Attract development
- Export goods
- Employment opportunities
- Costs of goods
- Tax base - diversified
 - extensive

Social (Ethnic, Personal Wealth)

Equality of opportunity

- . employment
- . education
- . amenities

Choice of opportunities

- . work
- . residence
- . travel

Services

- . welfare
- . training
- . guidance (protection) (friends)

Ability to absorb costs

- . moving
- . equivalent residence (replacement value)
- . psychological adjustment

Cultural

- Historical - landmarks - man-made
 - geological (topographic)

Recreational

- . extent - allotment of open space
- . variety - choice

Artistic

- . providing opportunities for learning
- . variety
- . self sufficiency

Political

Commitments

Policy

Attitudes of people

Political process (personalities)

Source: Discussions with R.L. Hart, City Planner
and Lois Dean, Social Analyst.

APPENDIX B-4
NOTES ON TRANSPORTATION CORRIDOR DESIGN

Recognizing the fact that highways have been instruments of social change unknowingly affecting the life style in cities, for many years, it is understood that the design of transportation corridors through an urban area requires careful thought and a great deal of assistance from planners, geographers, social analysts, economists, landscape architects and other specialists.

Work can commence on the design of long range regional transportation corridors:

- . after the conservation corridors have been identified and the design of a regional open space framework has commenced
- . after members of the design team have commenced studying the city to enhance their knowledge of the study area by noting features such as:

- natural and man-made topography
- history
- historical development patterns
- historical monuments
- landmarks
- cultural, ethnic and migration patterns
- neighbourhoods, communities, employment and activity districts
- employment and activity characteristics, and
- existing transportation systems

- . after studies have been made to determine the extent of the capital expenditure framework (the "capital web"), the future possibilities for different land uses - regional

activity frameworks, the trends indicated by the major land ownership framework, the quality of land and other permanent features.

The study of a city can indicate areas undergoing rapid change, long-standing, stable communities, and areas where the intrusion of a new facility could cause considerable hardship to the residents.

Taking such things into account as well as the permanent and other features of a city, alternative transportation corridors can be sketched using the chart on page 3 as general spacing criteria.

This chart is taken from an article "Transportation Systems in the Future Development of Metropolitan Areas" by J.E. Leisch. Other excerpts from this paper follow:

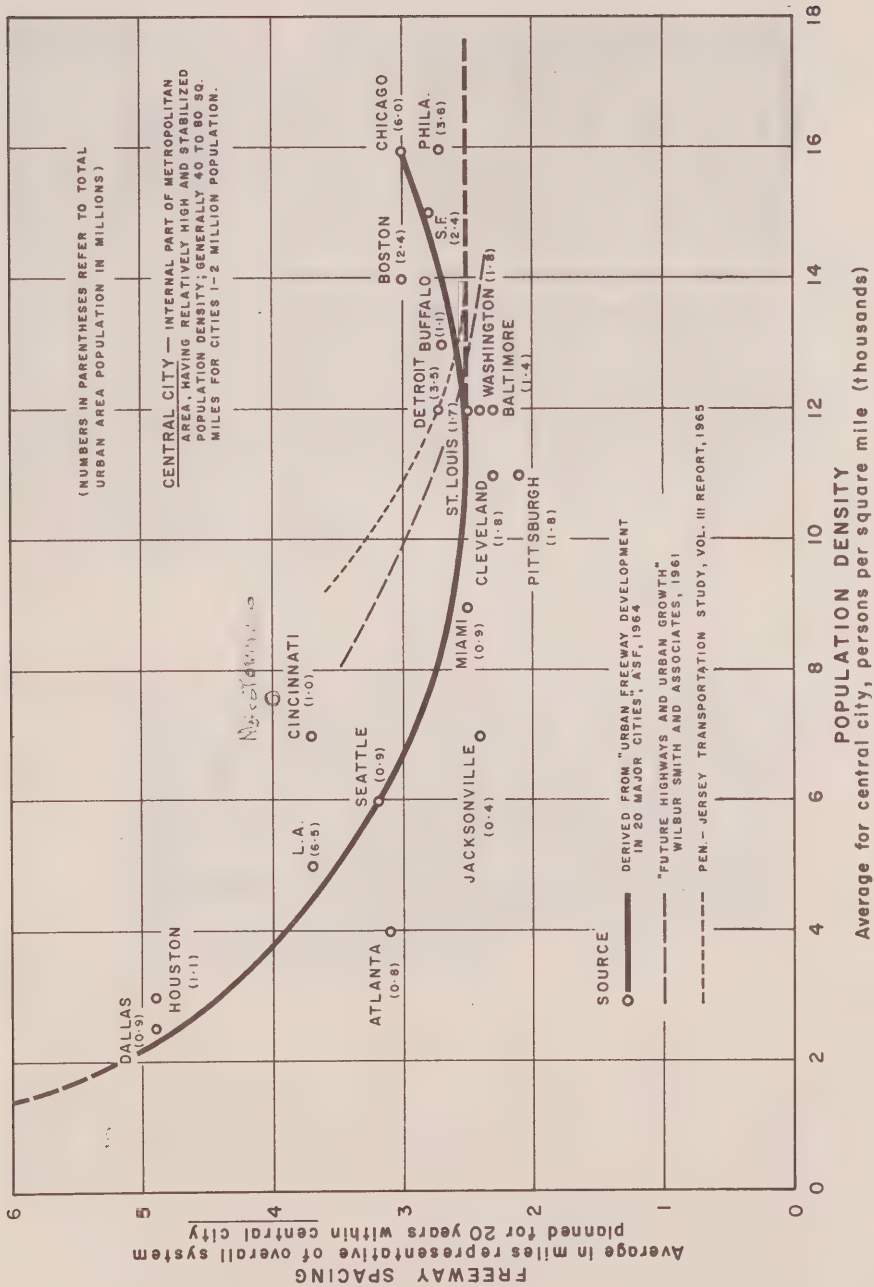


FIGURE 1.— Freeway spacing requirements indicated by planning studies in 20 cities

In actual application the major transportation framework is one of several frameworks that form the total urban structure. There are other urban features which have a fundamental and permanent significance. Some of these features are in the category of large capital improvements under government control, such as streets, schools, parks, sewers, and water supply. These features form additional frameworks and, together with transportation, may be planned jointly to shape the basic structure of tomorrow's metropolitan areas. Although this interrelationship is not specifically a part of this discussion, nevertheless its significance is stressed here to point out the necessity for coordinated effort in effective, long-range planning.

To account for the interaction between urban development and transportation, and to resolve the total planning problem, it is essential to have a number of disciplines working together—involving city planners; highway, traffic, and transit engineers; architects; economists; sociologists; political scientists, etc. Together they would plan for an appropriate balance of transportation and land development influences.

The network would by no means take on a regular rectangular pattern and would of course be integrated with the regional (provincial, state, federal) transportation framework, although arranged at optimum spacing as a whole. Land-use forms environmental areas and their interrelation, major travel desires, topography, historic and sociological aspects and other basic distinctive features of the area would shape the final network. The combined efforts of those involved in the design can result in a transportation network that reflects, emphasizes, and enhances the type, quality, recreational possibilities and the history of different features and areas in a city.

Source: Discussions with R.L. Hart, City Planner and
Lois Dean, Social Analyst.

72. Leisch, Jack E. "Transportation Systems in the Future Development of Metropolitan Areas", presented at the 48th meeting of the Highway Research Board, January 1969.

APPENDIX C

APPENDIX C-1
 DATA ON TRIP GENERATION AND PURPOSE
 FROM URBAN TRANSPORTATION STUDY REPORTS

TABLE 1

PERCENT OF TOTAL INTERNAL PERSON TRIPS
 BETWEEN HOME AND ALL DESTINATION PURPOSES

City	Year of Study	Percent
Charlotte, North Carolina	1958	83.9
Chicago, Illinois	1956	86.8
Detroit, Michigan	1953	87.0
Houston, Texas	1953	91.0
Kansas City, Missouri	1957	88.2
Nashville, Tennessee	1959	85.5
Phoenix, Arizona	1957	85.3
Pittsburgh, Pennsylvania	1958	87.0
St. Louis, Missouri	1957	91.3
Washington, D.C.	1955	91.6

TABLE 2

PERCENT OF TOTAL HOME-BASED INTERNAL TRIPS
 BETWEEN HOME AND DESTINATION PURPOSES

City	Purpose of Destination					
	Work	Business	Shop	School	Soc.Rec.	Other
Charlotte	32.2	8.0	15.6	6.6	23.8	13.8
Chicago	37.5	9.7	18.9	4.0	22.8	7.1
Detroit	41.6	8.6	13.9	6.3	20.1	9.5
Houston	33.1	8.9	17.3	10.8	18.6	11.3
Kansas City	33.4	8.8	17.2	6.0	22.7	11.9
Nashville	30.3	8.5	16.9	7.4	23.9	13.0
Phoenix	25.2	10.2	19.7	11.6	20.0	13.3
Pittsburgh	37.7	21.6	14.9	12.0	13.8	--
St. Louis	37.5	8.1	17.3	6.4	21.5	9.2
Washington	43.1	9.6	14.2	9.4	12.5	11.2

Note: Differences in percentages are due to many factors,
 one being the way in which each term is defined in
 various studies.

- Source: 105. Smith, Wilbur and Associates, "Future Highways and Urban Growth", The Automobile Manufacturers Association, Detroit 2, Michigan, February, 1961.
106. Smith, Wilbur and Associates, "Transportation and Parking for Tomorrow's Cities", The Automobile Manufacturers Association, Detroit 2, Michigan, 1966.

Table 5.—Number and percentage of trips by each mode of travel in six population groups, classified according to trip purpose

Table 5.—Number and percentage of trips by each mode of travel, by population group, by mode of travel, and by trip purpose														
Mode of travel	Population group	Num-ber of cities	Trip purpose											
			Work and busi-ness		Social and recrea-tion		Shop		Miscellaneous		Home		Total	
			Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent	Number	Per-cent
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	1,000,000 and over	4	1,143,303	35.4	300,892	9.3	201,334	6.2	414,396	12.9	1,165,651	36.2	3,225,576	100.0
			1,344,013	39.7	420,539	23.3	116,687	8.4	151,320	8.4	769,472	42.7	1,802,031	100.0
			1,401,980	28.2	345,528	7.0	309,684	6.2	884,034	17.8	2,027,099	40.8	4,968,325	100.0
			2,889,296	28.9	1,066,959	10.7	627,705	6.3	1,449,750	14.5	3,962,222	39.6	9,995,932	100.0
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	500,000-1,000,000	6	1,110,178	31.5	309,475	8.8	296,569	8.4	438,527	12.4	1,370,171	38.9	3,524,920	100.0
			70,884	16.6	402,040	23.0	145,159	8.3	156,448	9.0	753,517	43.1	1,746,874	100.0
			983,146	33.0	184,998	6.2	201,002	6.8	190,078	6.4	1,418,248	47.6	2,977,472	100.0
			2,383,034	28.9	896,513	10.9	642,730	7.8	785,053	9.5	3,541,936	42.9	8,249,266	100.0
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	250,000-500,000	3	234,358	33.9	72,134	10.4	58,241	8.4	84,678	12.2	242,866	35.1	692,277	100.0
			175,776	30.2	52,309	9.0	42,057	7.2	60,348	10.4	172,196	41.0	419,462	100.0
			481,018	28.4	234,594	13.8	135,073	8.0	176,482	10.4	666,333	39.4	1,693,500	100.0
			888,964	30.4	287,031	9.8	270,770	9.3	433,692	14.8	1,042,586	35.7	2,923,043	100.0
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	100,000-250,000	20	264,644	16.0	428,819	25.9	146,796	8.9	116,747	7.1	696,795	42.1	1,653,801	100.0
			330,220	26.3	115,567	9.2	104,161	8.3	108,051	8.6	596,264	47.6	1,254,263	100.0
			1,483,828	25.4	831,417	14.3	521,727	8.9	658,490	11.3	2,335,645	40.1	5,831,107	100.0
			242,565	30.0	87,961	10.9	65,073	8.0	117,711	14.6	294,964	36.5	808,274	100.0
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	50,000-100,000	12	79,696	17.5	120,083	26.3	35,941	7.9	24,855	5.3	195,281	42.8	455,856	100.0
			110,197	29.8	33,696	9.1	28,778	7.8	24,280	6.0	172,236	46.7	399,187	100.0
			432,458	26.5	241,740	14.8	129,792	7.9	166,846	10.2	662,481	40.6	1,633,317	100.0
			60,480	29.0	22,449	10.8	18,844	9.0	35,369	16.9	71,680	34.3	208,822	100.0
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	Less than 50,000	5	16,414	13.9	38,750	32.9	9,440	8.0	5,720	4.9	47,368	40.3	117,692	100.0
			12,784	26.6	4,389	9.2	4,753	9.9	3,670	7.6	22,423	46.7	48,019	100.0
			89,678	24.0	65,588	17.5	33,037	8.8	44,759	11.9	141,471	37.8	374,533	100.0
			3,679,848	32.3	1,079,942	9.5	910,831	8.0	1,524,373	13.4	4,187,918	36.8	11,382,912	100.0
Automobile drivers..... Automobile and taxi passengers..... Mass-transit passengers..... Total.....	All groups	50	1,063,313	17.2	1,520,382	24.5	488,798	7.9	486,546	7.9	2,634,629	42.5	6,195,716	100.0
			3,014,103	29.5	736,487	7.2	690,435	6.8	1,270,461	12.5	4,487,541	44.0	10,196,027	100.0
			7,759,312	27.9	3,336,811	12.0	2,090,064	7.5	3,281,380	11.8	11,310,088	40.8	27,777,655	100.0

Table 6.—Percentage of trips for each trip purpose in six population groups, classified according to mode of travel

Purpose of trip	Population group	Number of cities	Mode of travel			
			Auto- mobile drivers	Auto- mobile and taxi passengers	Mass- transit passengers	Total
Work and business	1,000,000 and over	4	39.6	11.9	48.5	100.0
Social and recreation			28.2	39.4	32.4	100.0
Shop			32.1	18.6	49.3	100.0
Miscellaneous			28.6	10.4	61.0	100.0
Home			29.4	19.4	51.2	100.0
All purposes			32.3	18.0	49.7	100.0
Work and business	500,000-1,000,000	6	46.6	12.2	41.2	100.0
Social and recreation			34.5	44.9	20.6	100.0
Shop			46.1	22.6	31.3	100.0
Miscellaneous			55.9	19.9	24.2	100.0
Home			38.7	21.3	40.0	100.0
All purposes			42.7	21.2	36.1	100.0
Work and business	250,000-500,000	3	48.7	14.7	36.6	100.0
Social and recreation			30.7	47.0	22.3	100.0
Shop			43.1	25.7	31.2	100.0
Miscellaneous			48.0	17.8	34.2	100.0
Home			36.5	25.8	37.7	100.0
All purposes			40.9	24.8	34.3	100.0
Work and business	100,000-250,000	20	59.9	17.8	22.3	100.0
Social and recreation			34.5	51.6	13.9	100.0
Shop			51.9	28.1	20.0	100.0
Miscellaneous			65.9	17.7	16.4	100.0
Home			44.7	29.8	25.5	100.0
All purposes			50.1	28.4	21.5	100.0
Work and business	50,000-100,000	12	56.1	18.4	25.5	100.0
Social and recreation			36.4	49.7	13.9	100.0
Shop			50.1	27.7	22.2	100.0
Miscellaneous			70.6	14.9	14.5	100.0
Home			44.5	29.5	26.0	100.0
All purposes			49.5	27.9	22.6	100.0
Work and business	Less than 50,000	5	67.4	18.3	14.3	100.0
Social and recreation			34.2	59.1	6.7	100.0
Shop			57.0	28.6	14.4	100.0
Miscellaneous			79.0	12.8	8.2	100.0
Home			50.7	33.5	15.8	100.0
All purposes			55.8	31.4	12.8	100.0
Work and business	All groups	50	47.4	13.7	38.9	100.0
Social and recreation			32.4	45.5	22.1	100.0
Shop			43.6	23.4	33.0	100.0
Miscellaneous			46.5	14.8	38.7	100.0
Home			37.0	23.3	39.7	100.0
All purposes			41.0	22.2	36.8	100.0

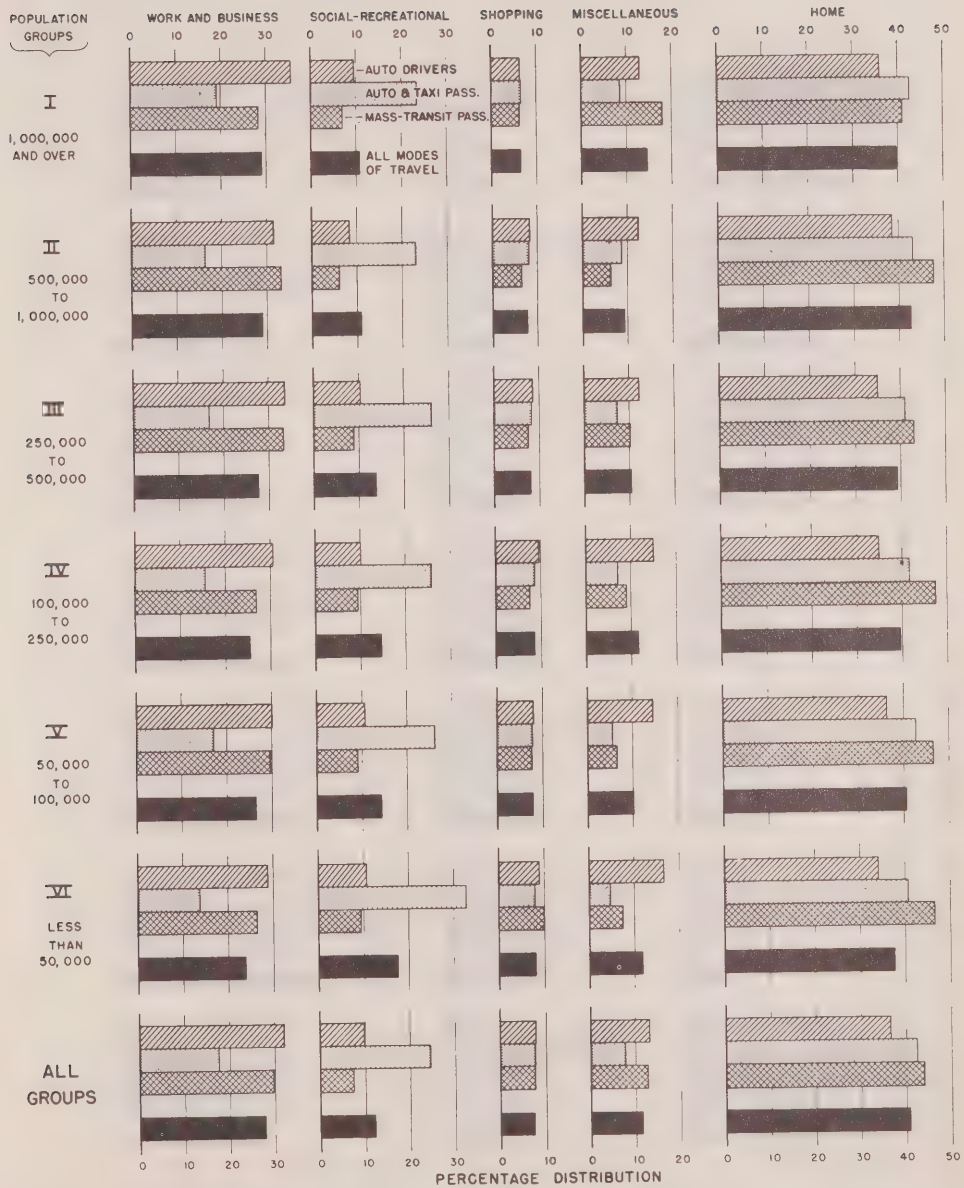


Figure 3. Percentage distribution of trips according to purpose, and further classified by mode of travel and population group.

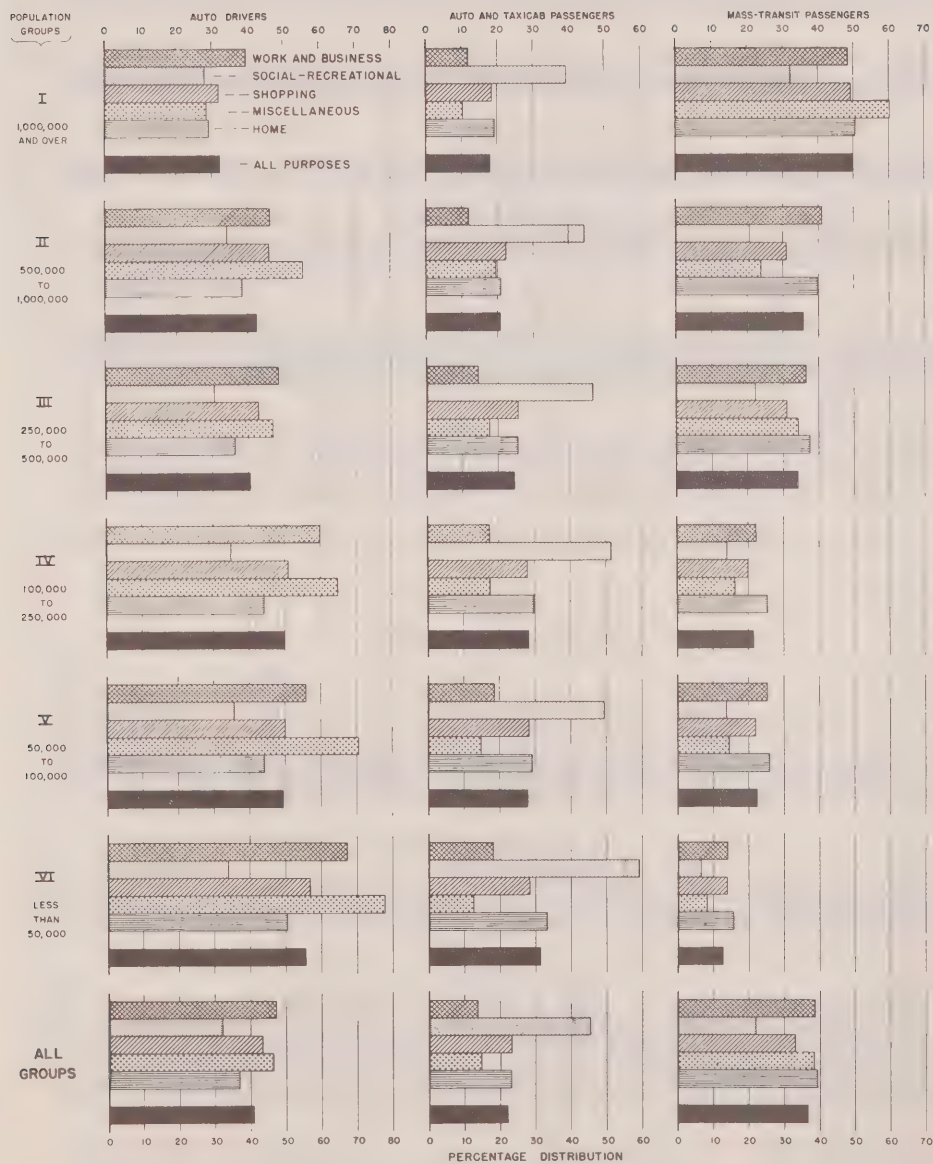


Figure 4. Percentage distribution of trips according to mode of travel, and further classified by purpose and population group.

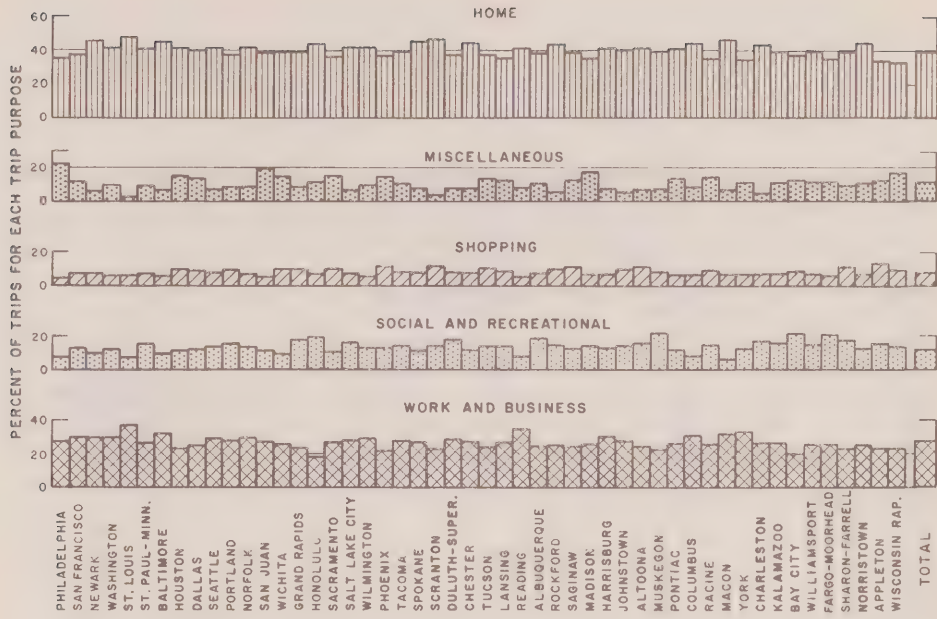


Figure 5. Percentage distribution of trips in each city, according to purpose.



Figure 6. Percentage distribution of trips in each city, according to mode of travel.

Table 7.—Range in percentage of trips for each trip purpose by each mode of travel in six population groups

Mode of travel	Percentage range, by mode of travel, in trips made for purposes of—					
	Work and business	Social and recreation	Shop	Miscellaneous	Home	All purposes
Automobile drivers:						
Maximum.....	67.4	36.4	57.0	79.0	50.7	55.8
Minimum.....	39.6	28.2	32.1	28.6	29.4	32.3
Automobile and taxi passengers:						
Maximum.....	18.4	59.1	28.6	19.9	33.5	31.4
Minimum.....	11.9	39.4	18.6	10.4	19.4	18.0
Mass-transit passengers:						
Maximum.....	48.5	32.4	49.3	61.0	51.2	49.7
Minimum.....	14.3	6.7	14.4	8.2	15.8	12.8

Table 11.—Range in percentage of trips for each trip purpose by each mode of travel in 50 cities

Mode of travel	Percentage range, by mode of travel, in trips made for purposes of —				
	Work and business	Social and recreation	Shop	Miscellaneous	Home
Automobile drivers:					
Maximum.....	41.3	16.8	13.6	20.1	47.6
Minimum.....	22.9	4.0	4.5	4.1	30.4
Automobile and taxi passengers:					
Maximum.....	31.7	39.3	13.7	12.2	47.9
Minimum.....	10.6	12.3	4.5	2.5	36.7
Mass-transit passengers:					
Maximum.....	36.9	16.3	17.3	28.9	54.5
Minimum.....	12.9	3.0	1.0	2.3	35.9
All modes of travel:					
Maximum.....	36.6	22.0	13.1	22.8	48.2
Minimum.....	18.6	6.9	4.6	3.1	34.4

Table 12.—Range in percentage of trips by each mode of travel for each trip purpose in 50 cities

Purpose of trip	Percentage range, by purpose of trip, in trips made by—		
	Automobile drivers	Automobile and taxi passengers	Mass-transit passengers
Work and business:			
Maximum.....	79.2	24.9	78.5
Minimum.....	14.5	4.8	.7
Social and recreation:			
Maximum.....	45.9	65.9	61.5
Minimum.....	13.8	10.7	.3
Shop:			
Maximum.....	70.6	35.4	78.2
Minimum.....	10.8	4.7	.1
Miscellaneous:			
Maximum.....	84.9	37.5	85.4
Minimum.....	9.0	5.6	2.1
Home:			
Maximum.....	65.1	38.7	79.5
Minimum.....	8.8	5.6	2.1
All purposes:			
Maximum.....	67.9	35.7	77.5
Minimum.....	11.1	5.6	1.3

Table 14.—Percentage of trips for each mode of travel in 50 cities, classified according to purpose at both origin and destination

Purpose	Mode of travel ¹			
	Automobile drivers	Automobile and taxi passengers	Mass-transit passengers	All modes of travel
Home.....	73.9	84.7	88.6	81.8
Work and business.....	64.8	34.9	58.6	55.8
Social-recreation.....	19.0	49.8	14.0	24.0
Miscellaneous.....	26.4	14.8	25.2	23.4
Shopping.....	15.9	15.8	13.6	15.0
Total....	200.0	200.0	200.0	200.0

¹ Percentages add to 200 for each mode of travel because the purpose of each trip is considered twice, at place of origin (purpose from) and at place of destination (purpose to).

Table 13.—Number and percentage of trips by each mode of travel in 50 cities from each purpose to each purpose

Trips to —									
Trips from —	Work and business		Social and recreation		Shop		Miscellaneous		Total
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number
AUTOMOBILE DRIVERS									
Work and business.....	1,137,747	4.1	69,070	0.2	103,456	0.4	338,519	1.2	2,042,942
Social and recreation.....	31,001	.1	135,360	.5	43,584	.2	93,036	.3	774,933
Shop.....	43,624	.2	46,590	.2	138,449	.5	237,608	.9	628,494
Miscellaneous.....	340,199	1.2	63,187	.3	74,334	.2	93,747	.3	741,549
Home.....	2,127,277	7.6	735,729	2.7	551,018	2.0	811,448	2.9	4,486,927
Total.....	3,679,848	13.2	1,079,942	3.9	910,831	3.3	1,324,373	5.5	11,382,912
AUTOMOBILE AND TAXI PASSENGERS									
Work and business.....	117,942	0.4	42,639	0.2	36,541	0.1	61,531	0.2	837,854
Social and recreation.....	21,397	.1	395,659	1.1	40,438	.1	38,734	.1	1,199,437
Shop.....	12,575	.1	41,213	.1	73,229	.2	351,404	1.3	487,823
Miscellaneous.....	48,892	.2	51,781	.1	17,394	.1	26,310	.1	430,281
Home.....	864,385	3.1	1,079,090	3.9	321,196	1.1	350,569	1.3	2,615,240
Total.....	1,065,361	3.9	1,520,352	5.5	488,798	1.6	486,546	1.7	6,195,716
MASS-TRANSIT PASSENGERS									
Work and business.....	118,402	0.4	35,234	0.1	38,464	0.2	233,567	0.9	2,533,978
Social and recreation.....	9,086	-----	35,088	.1	12,298	-----	30,620	.2	598,636
Shop.....	13,399	-----	21,087	.1	23,085	-----	44,347	.2	590,706
Miscellaneous.....	2,635,929	9.5	52,453	.2	53,733	.2	189,914	.7	707,221
Home.....	3,014,103	10.8	592,025	2.1	562,925	2.1	762,994	2.7	4,553,573
Total.....	5,886,817	21.7	716,825	2.6	690,435	2.6	1,270,461	4.6	10,199,027
ALL MODES OF TRAVEL									
Work and business.....	1,374,091	4.9	146,943	0.5	178,461	0.7	633,717	2.3	5,414,774
Social and recreation.....	69,598	.2	476,713	1.7	96,230	.3	171,409	.6	2,570,064
Shop.....	69,598	.2	108,980	.4	284,763	.8	97,351	.4	1,570,064
Miscellaneous.....	626,348	2.3	197,421	.7	145,471	.5	453,892	1.6	1,797,704
Home.....	5,627,591	20.2	2,406,844	8.7	1,435,139	5.2	1,925,011	6.9	11,594,385
Total.....	7,759,312	27.9	3,336,811	12.0	2,090,064	7.5	3,251,380	11.8	27,777,655

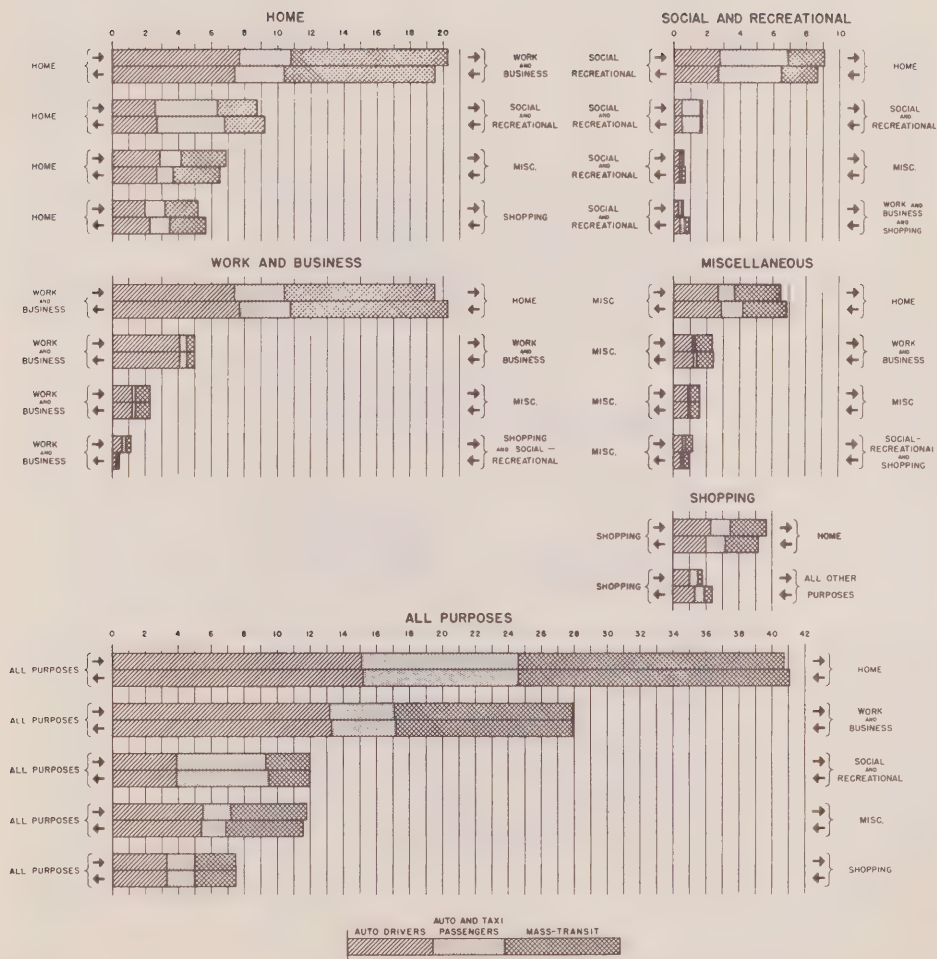


Figure 7. Percentage distribution of trips from each purpose to each purpose, by mode of travel.

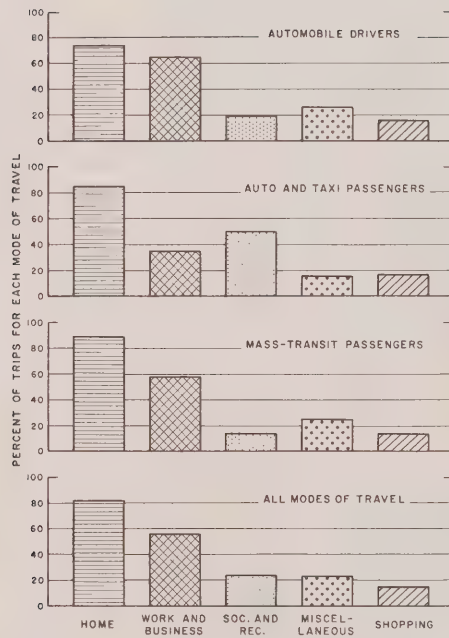


Figure 8. Percentage distribution of trips, both from and to each purpose, by mode of travel.

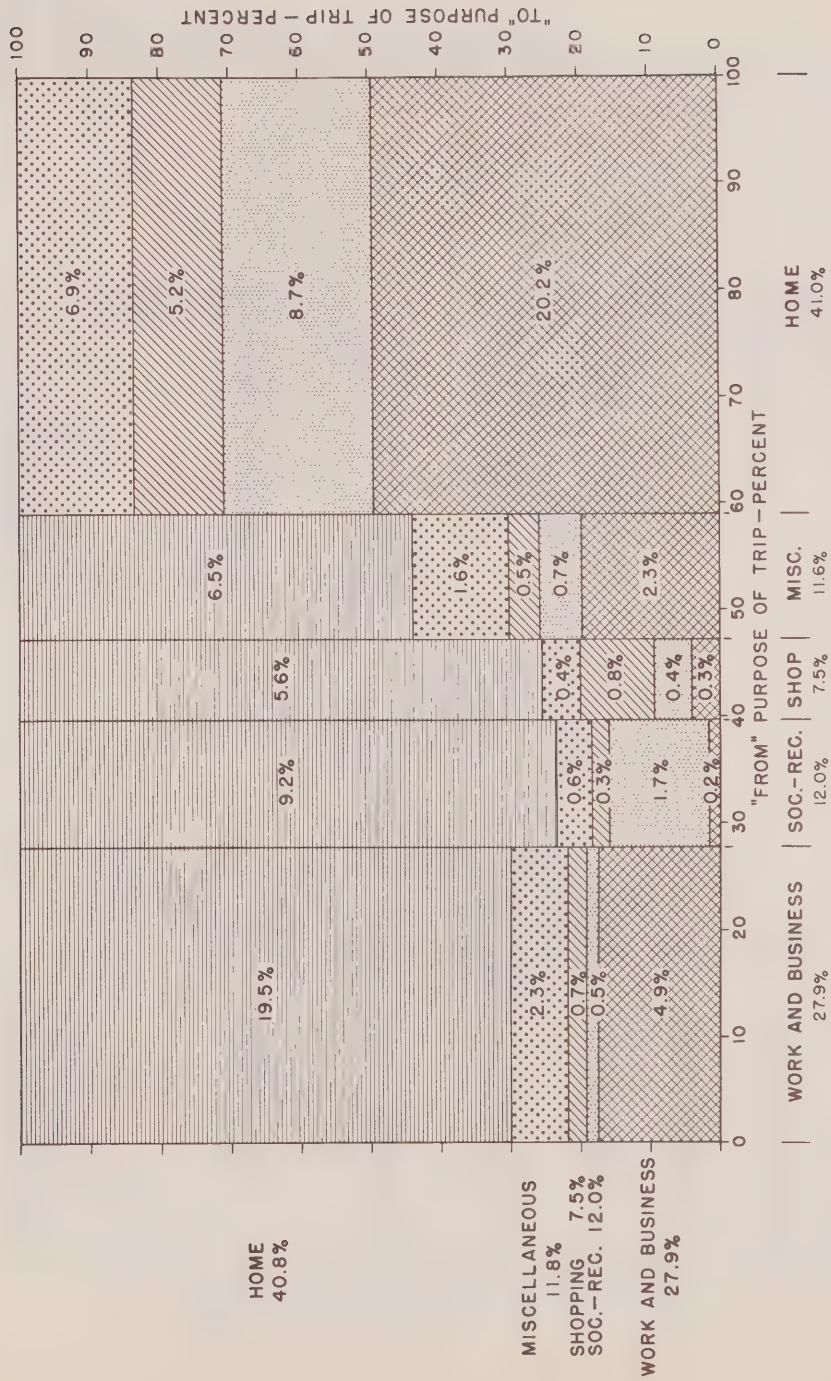


Figure 9. Percentage distribution of trips from each purpose to each purpose.

APPENDIX C-3
DATA ON TRIP GENERATION, PURPOSE AND MODE
FROM TWO SAN DIEGO RESIDENTIAL COMMUNITIES

TABLE 2
CUSTOMERS BY TYPE ACTIVITY
ALLIED GARDENS BUSINESS DISTRICT

Type Activity	Number of Customers	
	Thursday 7-12-56	Saturday 7-14-56
Service Station	189	209
Radio-TV Shop	14	21
Laundromat	48	81
Medical/Dental Office	15	Not Open
Barber Shop	38	54
Beauty Shop	39	42
Market	1,200	2,000
Shoe Sales-Repair	24	37
Variety Store	265	328
Drug Store	401	436
Total Customers	2,233	3,208

TABLE 6
VEHICLES PER DWELLING UNIT BY TYPE OF DWELLING
UNIT VEHICLES GARAGED AT DWELLING UNIT

Type Dwelling Unit	Automobiles	All Vehicles
Apartments—Clairemont	1.09	1.08
Duplexes—Clairemont	1.16	1.20
Single Family, medium valuation Clairemont	1.15	1.21
Allied Gardens	1.22	1.27
Single Family, high valuation Clairemont	1.39	1.42
All Types—Clairemont	1.20	1.24
Combined Allied Gardens and Clairemont	1.21	1.25

TABLE 7
RESIDENT TRIP GENERATION PER DWELLING UNIT IMPACT ON METROPOLITAN AREA

Trip Description	Area and Type Dwelling Unit							
	Allied Gardens	Clairemont					Average	Combined Average
	Single Family Medium Value	Single Family Medium Value	Single Family High Medium Value	Duplex	Apartment			
5-Day								
All	10.63	10.89	11.53	8.33	8.32	10.00	10.21	
Auto Driver	6.96	5.83	6.74	4.45	4.82	5.54	6.01	
Auto-Truck Driver	7.39	6.47	6.79	4.62	4.82	5.83	6.33	
Auto-Truck Passenger	3.02	4.15	4.39	3.26	3.17	3.83	3.56	
Mass Transit Passenger	0.20	0.28	0.33	0.41	0.30	0.33	0.29	
7-Day								
All	10.61	11.90	12.21	8.42	8.34	10.59	10.58	
Auto Driver	6.56	6.05	7.12	4.69	4.82	5.78	6.04	
Auto-Truck Driver	7.14	6.70	7.21	4.85	4.82	6.08	6.44	
Auto-Truck Passenger	3.29	4.99	4.69	3.24	3.27	4.23	3.92	
Mass Transit Passenger	0.17	0.21	0.32	0.32	0.25	0.27	0.24	
Saturday								
Auto-Truck Driver	7.93	6.29	8.00	6.83	4.40	6.54	7.05	
Sunday								
Auto-Truck Driver	4.42	8.18	9.78	4.17	5.20	7.19	6.28	

TABLE 8
RESIDENT TRIP GENERATION OF DRIVER TRIPS PER DWELLING UNIT

Trip Description	Allied Gardens	Clairemont					Combined Average
	Single Family Medium Value	Single Family Medium Value	Single Family High Medium Value	Duplex	Apartment	Average	
5-Day Auto							
All	6.96	5.83	6.74	4.45	4.82	5.54	6.01
One or both ends in area	4.33	4.46	4.78	3.70	3.66	4.25	4.24
One end at home	3.88	3.79	4.34	3.19	3.13	3.67	3.73
5-Day Auto-Truck							
All	7.39	6.47	6.79	4.62	4.82	5.83	6.33
One or both ends in area	4.39	4.77	4.78	3.76	3.66	4.37	4.37
One end at home	3.92	3.96	4.34	3.24	3.13	3.74	3.80

TABLE 10
WEEKDAY AUTO-TRUCK TRIP PURPOSE PERCENTAGE DISTRIBUTION

Destination Purpose	Trip Purpose as Percent of Total						
	24-Hr 1952-53 O-D Summary	Allied Gardens			Clairemont		
		24-Hr	A. M. Peak Period	P. M. Peak Period	24-Hr	A. M. Peak Period	P. M. Peak Period
Work	15.3	15.6	55.2	8.6	16.3	58.0	3.5
Related Business	21.5	19.8	4.7	18.9	7.1	4.4	2.7
Subtotal	36.8	35.4	59.9	27.5	23.4	62.4	6.2
Medical and Dental	0.7	0.8	1.0	-	0.7	-	-
Shopping	-	-	-	-	-	-	-
Convenience Goods	-	9.3	1.9	10.0	9.9	1.1	14.5
Shopping Goods	-	2.5	0	1.3	2.5	0	1.0
Total	7.9	11.8	1.9	11.3	12.4	1.1	15.5
Education, Civic and Religion	1.3	0.5	1.9	-	0.7	2.7	-
Eat Meal	1.7	2.0	1.0	1.8	2.7	2.2	1.6
Serve Passenger	10.4	11.6	24.8	12.2	13.6	24.6	19.3
Personal Business	5.1	6.4	1.0	5.4	6.8	1.1	6.5
Change Travel Mode	0.5	0.6	3.8	0.5	0.5	1.6	-
Home	28.6	26.0	3.8	37.8	31.7	3.3	45.6
Subtotal	56.2	59.7	39.2	69.0	68.9	36.6	88.5
Vacation	-	-	-	-	0.2	-	-
Pleasure	0.4	1.6	-	1.3	2.2	0.5	1.4
Others	6.4	3.2	1.0	2.3	5.2	0.5	3.8
Subtotal	6.8	4.8	1.0	3.6	7.6	1.0	5.2
Unknown	0.2	-	-	-	-	-	-
Total	100.0	99.9	100.1	100.1	99.9	100.0	99.9

Source: 47. Hall, Edward M., "Travel Characteristics of Two San Diego Subdivision Developments Highway Research Board Bulletin 203 January 1958.

APPENDIX C-4
DATA ON TRAVEL MODES IN THE CHICAGO AREA

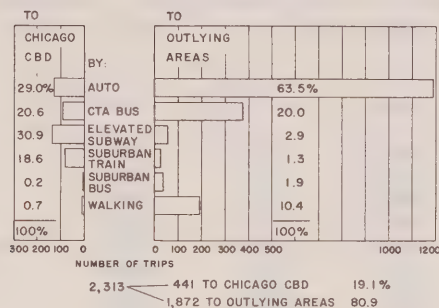


Figure 1. Mode of Travel for Work Trips, General Sample.

Of the six districts studied in the Chicago area, data from the district in which the residents had an above average income showed the number of automobile trips to be higher to both the CBD and to the outlying areas.

Source: 89. Mortimer William J., "Transportation Usage Study", Highway Research Board Bulletin 203 January 1958.

APPENDIX C-5
DATA ON TRIP GENERATION PURPOSE AND MODE
FOR WASHINGTON D.C.

TABLE 2
TRIPS REPORTED IN HOME INTERVIEWS - BY MODE - 1948
TRIP PURPOSES OTHER THAN HOME

Purpose to or from	Auto Drivers	Auto and Truck Pass.	Taxi Pass.	Transit Riders	All Modes
Work	268,788	110,740	14,889	388,758	783,175
Business	45,297	15,708	4,975	40,577	106,557
Medical and dental	6,725	5,989	3,294	11,962	27,970
School	9,501	16,578	583	48,652	75,314
Social and recreational	104,123	153,546	15,080	92,762	365,511
Change mode	4,068	10,247	2,764	15,704	32,783
Eat meal	16,695	10,810	1,723	10,718	39,946
Shopping	80,508	40,026	3,809	68,158	192,501
Serve passenger	95,828	3,464	152	669	100,113
Total	631,533	367,108	47,269	677,960	1,723,870

Note: Trip information from "Washington Metropolitan Area Transportation Study, 1950."

TABLE 3
TRIPS REPORTED IN HOME INTERVIEWS - BY MODE - 1955
TRIP PURPOSES OTHER THAN HOME

Purpose to or from	Auto Drivers	Auto and Truck Pass.	Taxi Pass.	Transit Riders	All Modes
Work	500,287	213,311	20,524	341,565	1,075,687
Business	103,987	43,901	7,533	44,292	199,713
Serve passenger	260,494	24,360	448	689	285,991
Change mode	14,493	18,161	2,886	19,986	55,526
Social and recreation	127,892	153,615	11,800	37,704	331,011
Shopping (grocery-drug)	127,301	53,778	1,757	8,547	191,383
Shopping (other)	90,139	48,900	5,312	46,175	190,526
School	23,224	66,307	780	123,586	213,897
Medical, dental, eat	30,535	27,496	7,898	16,869	82,798
Total	1,278,352	649,829	58,938	639,413	2,626,532

Note: Trips from final tabulations prepared by Regional Highway Planning Committee.

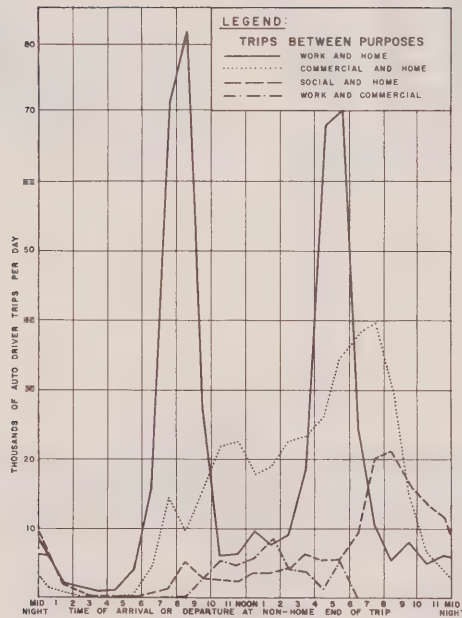
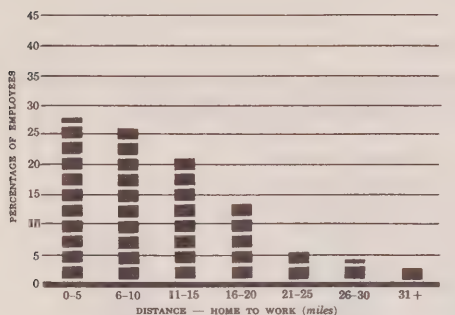


Figure 5. Hourly distribution of trips made by residents in 1955; auto drivers by purpose of trip.

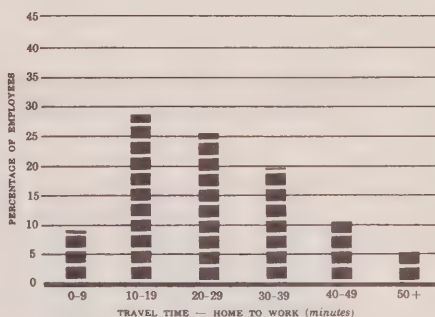
Source: 136. Wynn, F. Houston, "Studies of Trip Generation in the Nation's Capital 1956-58" Highway Research Board Bulletin 230 January 1959.

APPENDIX C-6

DATA ON WORK TRIP CHARACTERISTICS FOR EMPLOYEES OF SELECTED INDUSTRIAL PLANTS IN THE BOSTON AREA



Distance home to work for employees of industries located on Route 128
September 1957



Travel time to work for employees of industries located on Route 128
September 1957

TABLE 9

SUMMARY OF TRAVEL PATTERN CHARACTERISTICS FOR EMPLOYEES
WORKING AT AN IN-TOWN PRODUCTION PLANT AND FOR OLD ROUTE
128 EMPLOYEES AFTER STARTING TO WORK AT A ROUTE 128 PLANT

Employee Group and Mode	Employees in Mode (%)	Average Travel Time Home-to-Work (min)	Average Distance Home-to-Work (miles)	Average Speed of Trip (mph)
In-town workers				
Car	73.9	30	10.5	21
Public transit	16.8	36	5.5	9
Walk	4.1	14	0.9	4
Combinations	5.2	40	7.5	11
All Modes	100.0	30	10.5	21
Old Route 128 workers				
All Modes	100.0	28	13.2	28

Source: 130. Wohl, Martin, A.J. Bone, Billy Rose
"Traffic Characteristics of Massachusetts
Route 128", Highway Research Bulletin 230
January 1959.

APPENDIX C-7

DATA ON TRIP GENERATION RELATED TO FLOOR AREA IN THE CENTRAL BUSINESS DISTRICT

TABLE 4

FLOOR SPACE; PERSON DESTINATIONS; ESTIMATED PERSON DESTINATIONS;
AND ERROR IN ESTIMATE—PHILADELPHIA ALL CBD ZONES

REGRESSION EQUATION: $\hat{Y} = 14.602X_1 + 5.858X_2 + 1.276X_3 - 3470$

O-D ZONE	FLOOR SPACE: 1000's Sq.Ft.			O-D PERSON DESTINATIONS (24 hrs.) Y	EST'D PERSON DESTINATIONS (24 hrs.) \hat{Y}	$\hat{Y} - Y$	% ERROR
	RETAIL X_1	SERVICE-OFFICE X_2	MAN'G-WHSG. X_3				
0001; 0002	1809	11,118	1473	88,490	89,950	+1460	+ 1.6
0003	41	2130	144	28,860	9,790	-19,020	- 66
0005; 0006	4366	6811	2290	103,690	103,100	- 690	- 0.6
0007; 0008	2975	3818	2633	77,200	65,700	-11,500	-15
0043	23	781	0	3700	1440	2260	-61
0042	15	165	12	1790	-2270*		
0041	105	160	87	3700	-980*		
0063	86	729	612	2540	2840	+300	+12
0064	97	431	257	2180	800	-1300	-60
0009	2684	441	1706	36,590	40,480	+3890	+11
0061	71	658	196	8340	1670	-6670	-80
0062	174	1172	196	6260	6190	-70	-1.1
0027; 0029; 0032	906	3581	604	26,510	31,510	+5000	+19
0045	346	1484	281	4550	10,630	+6080	+134
0047	231	1067	246	3850	6470	+2620	+68
0082	92	2783	1642	13,660	16,270	+2610	+19
0091	843	1921	2351	17,220	23,090	+5870	+34
0073	300	491	1502	3270	5700	+2430	+74
0026; 0028; 0031	668	1897	628	10,950	18,200	+7250	+66
0023; 0025	558	1703	252	9540	14,980	+5440	+57
0044	348	250	370	1970	3550	+1580	+80
0046	383	226	325	1940	3860	+1920	+99
0081	629	755	860	5500	11,230	+5730	+104
0052	440	2360	3779	23,430	21,600	-1830	-8
0053	261	1158	4234	6970	12,530	+5560	+80
0051	242	223	565	2190	2090	-100	-4.5
0092	147	859	2702	6200	7160	+960	+15
0072	154	277	227	2030	690	-1340	-66
0071	205	333	1390	4080	3250	-830	-20
0022; 0024	176	344	150	2690	1310	-1380	-51
0021	117	211	76	2450	-430*		

Variance of Estimate $S^2(\hat{Y}) = 30,178,700$

Standard Error of Estimate $S(y) = 5490$ Person Destinations

Coefficient of Multiple Determination $R^2 = 0.960$

	X_1	X_2	X_3	K
95 % Confidence Range	11.873	4.709	-0.693	+2120
of Equation Parameters	17.331	7.007	3.245	-9080

TABLE 5
FLOOR SPACE; PERSON DESTINATIONS; ESTIMATED PERSON DESTINATIONS; AND
ERROR IN ESTIMATE—DETROIT CBD ZONES

REGRESSION EQUATION :— $\hat{Y} = 13.918 X_1 + 4.613 X_2 + 1.717 X_3 - 2280$

O-D DISTRICT	FLOOR SPACE 1000's Sq. Ft.			O-D PERSON DESTINATIONS (24 hrs.) Y	EST'D PERSON DESTINATIONS (24 hrs.) \hat{Y}	$\hat{Y} - Y$	% ERROR
	RETAIL X_1	SERVICE —OFFICE X_2	MANU'F. —WAREHOUSING X_3				
00	5400	2721	86	85,850	85,580	-270	- 0.3
01	2454	14,162	1573	99,670	99,900	+230	+ 0.2
11	480	3259	3348	25,260	25,180	- 80	- 0.3
12	440	1494	1154	8,210	12,710	+4500	+55
13	140	761	10	2,760	3,200	+440	+ 16
15	193	1968	789	11,800	10,840	-960	- 8
17	426	2680	721	19,030	17,250	-1780	- 9
19	102	1330	1578	10,000	7,980	-2020	- 20

VARIANCE of ESTIMATE $S^2(\hat{Y}) = 7,804,000$

STANDARD ERROR of ESTIMATE $S(\hat{Y}) = 2,790$ PERSON DESTINATIONS

COEFFICIENT of MULTIPLE DETERMINATION $R^2 = 0.997$

	X_1	X_2	X_3	K
95 % CONFIDENCE RANGE	12.086	3.864	-1.392	+ 6180
of EQUATION PARAMETERS	15.750	5.362	4.862	-10740

TABLE 6
FLOOR SPACE; PERSON DESTINATIONS; ESTIMATED PERSON DESTINATIONS; AND
ERROR IN ESTIMATE—BALTIMORE CBD

REGRESSION EQUATION:— $\hat{Y} = 12.871X_1 + 4.524X_2 + 1.343X_3 - 1080$

O-D ZONE	FLOOR SPACE: 1000's Sq. Ft.			O-D PERSON DESTINATIONS (24 hrs.) Y	EST'D. PERSON DESTINATIONS (24 hrs.) \hat{Y}	$\hat{Y}-Y$	% ERROR
	RETAIL X_1	SERVICE-OFFICE X_2	MAN'G-WHSG. X_3				
010	289	888	1456	9,780	8,670	-1110	- 11
011	1356	1245	1538	19,410	23,770	+4360	+ 22
012	596	1607	1538	20,300	15,990	-4310	- 21
020	661	2739	689	21,230	20,750	- 480	- 2
021	88	1348	1384	9,910	8,040	-1870	- 19
022	258	1562	70	15,300	9,440	-5860	- 38
023	106	430	269	3,670	2,680	+ 990	+ 27
030	1323	852	177	27,830	20,180	-7650	- 27
031	1203	1504	143	18,110	21,500	+3390	+ 19
040	194	1723	53	7,570	9,310	+1740	+ 23
041	140	1445	721	2,620	8,260	+5640	+215
051	560	877	459	3,460	10,880	+7420	+214

VARIANCE of ESTIMATE $S^2(\hat{Y}) = 31,720,600$ STANDARD ERROR of ESTIMATE $S(\hat{Y}) = 5,630$ PERSON DESTINATIONS

COEFFICIENT of MULTIPLE DETERMINATION $R^2 = 0.667$

	X_1	X_2	X_3	K
95% CONFIDENCE RANGE	5.046	-2.005	-5.193	+4810
of EQUATION PARAMETERS	20.818	10.953	7.859	-30,580

TABLE 7
FLOOR SPACE; PERSON DESTINATIONS; ESTIMATED PERSON DESTINATIONS; AND
ERROR IN ESTIMATE—SEATTLE CBD

REGRESSION EQUATION:— $\hat{Y} = 13.678 X_1 + 4.382 X_2 + 0.152 X_3 - 200$

O - D ZONE	FLOOR SPACE 1000's Sq. Ft.			O-D PERSON DESTINATIONS (24 hrs.) Y	EST'D. PERSON DESTINATIONS (24 hrs.) \hat{Y}	$\hat{Y} - Y$	% ERROR
	RETAIL X_1	SERVICE -OFFICE X_2	MANUF -WAREHOUSING X_3				
012	138	1200	320	5,800	6,990	-1190	-20
013	1248	678	73	22,760	19,850	+2910	+13
014	1118	1374	112	19,850	21,130	-1280	-6
015	62	870	148	4,160	4,480	-320	-8
016	1380	940	25	21,110	22,800	-1690	-8
017	370	2356	23	16,160	15,190	+970	+6
002	105	629	397	3,420	4,050	-630	-18
003	191	2096	0	11,750	11,600	+150	+1
004	70	2143	0	9,170	10,150	-980	-11
005	44	1276	238	6,920	6,030	+890	+13
006	29	328	530	2,960	1,710	+1250	+42
007	25	1702	22	8,950	7,600	+1350	+15
008	22	591	191	1,340	2,720	-1380	-103

VARIANCE of ESTIMATE $S^2(\hat{Y}) = 2,539,700$

STANDARD ERROR of ESTIMATE $S(\hat{Y}) = 1590$ PERSON DESTINATIONS

COEFFICIENT of MULTIPLE DETERMINATION $R^2 = 0.965$

	X_1	X_2	X_3	K
95% CONFIDENCE RANGE	11.077	1.781	-10.637	+5720
of EQUATION PARAMETERS	16.279	6.983	+10.941	-6110

TABLE 8
FLOOR SPACE; PERSON DESTINATIONS; ESTIMATED PERSON DESTINATIONS; AND
ERROR IN ESTIMATE—VANCOUVER CBD

REGRESSION EQUATION: $\hat{Y} = 14.322 X_1 + 10.534 X_2 + 3.670 X_3 + 1560$

O-D ZONE	FLOOR SPACE: 1000's Sq. Ft.			O-D PERSON DESTINATIONS (24 hrs.) Y	EST'D. PERSON DESTINATIONS (24 hrs.) \hat{Y}	$\hat{Y} - Y$	% ERROR
	RETAIL X	SERVICE-OFFICE X	MAN'FG-WHSG. X				
900	382	3692	44	46,900	46,080	- 820	- 1.7
901	1674	2124	87	48,640	48,230	- 410	- 0.8
902	43	142	44	4,400	3830	- 570	- 13
910	176	1273	610	18,530	19,730	+1200	+ 6
911	3	513	0	1,860	7,000	+5140	+276
920	321	690	566	14,220	15,500	+1280	+ 9
921	4	45	392	2,630	3530	+ 900	+ 34
930	10	88	1350	12,580	6020	-6560	- 52
940	86	503	174	14,110	8730	-5380	- 38
950	1294	1348	1176	39,460	38,610	- 850	- 2
951	443	717	1525	16,450	21,050	+4600	+ 28

VARIANCE of ESTIMATE $S^2(\hat{Y}) = 15342,400$

STANDARD ERROR of ESTIMATE $S(Y) = 3920$ PERSON DESTINATIONS

COEFFICIENT of MULTIPLE DETERMINATION $R^2 = 0.963$

	X_1	X_2	X_3	K
95% CONFIDENCE RANGE	8.126	7.223	- 1.887	+ 10,420
of EQUATION PARAMETERS	20.518	13.845	9.227	- 7300

TABLE 9
FLOOR SPACE; PERSON DESTINATIONS; ESTIMATED PERSON DESTINATIONS;
ERROR IN ESTIMATE—TACOMA CBD ZONES
REGRESSION EQUATION — $\hat{Y} = 7.709X_1 + 2.493X_2 - 17.698X_3 + 3590$

O-D ZONE	FLOOR SPACE: 1000's Sq.Ft.			O-D PERSON DESTINATIONS	EST'D. PERSON DESTINATIONS	$\hat{Y} - Y$	%ERROR
	RETAIL	SERVICE - OFFICE	MAN'G. -WAREHOUSING	(24 hrs) Y	(24 hrs) \hat{Y}		
	X_1	X_2	X_3				
000	226	902	78	6450	6200	-250	- 3.8
001	100	719	29	4610	5640	+1030	+ 22
002	1174	1025	63	13,540	14,050	+ 510	+ 3.7
003	300	726	133	6970	5360	-1610	-23
004	218	319	194	2360	2630	+270	+16

VARIANCE of ESTIMATE $S^2(\hat{Y}) = 6300$

STANDARD ERROR of ESTIMATE $S(\hat{Y}) = 80$ PERSON DESTINATIONS

COEFFICIENT of MULTIPLE DETERMINATION $R^2 = 0.997$

	X_1	X_2	X_3	K
95% CONFIDENCE RANGE	5.676	-2.589	-0.672	+6470
of EQUATION PARAMETERS	9.742	7.575	-34.724	+ 700

TABLE 10
FLOOR SPACE; PERSON DESTINATIONS; ESTIMATES PERSON DESTINATIONS; AND
ERROR IN ESTIMATE-DALLAS CBD

REGRESSION EQUATION: $\hat{Y} = 16.191X_1 + 3.546X_2 + 12.652X_3 - 8570$

O-D ZONE	FLOOR SPACE 1000's Sq. Ft.			O-D PERSON DESTINATIONS	EST'D. PERSON DESTINATIONS	$\hat{Y} - Y$	% ERROR
	RETAIL X_1	SERVICE -OFFICE X_2	MANU'F. -WAREHOUSING X_3	(24 hrs.) Y	(24 hrs.) \hat{Y}		
01	509	740	874	18,380	13,350	-5030	- 27
02	15	404	546	3,840	10	-3834	-100
03	344	289	316	3,010	2,020	- 990	- 33
04	1474	5674	183	40,130	37,730	-2400	- 6
05	243	1558	1071	11,730	14,440	+2710	+ 23
06	940	2577	356	14,870	20,290	+5420	+ 36
07	676	542	114	3,070	5,740	+2670	+ 87
08	1499	1979	0	23,730	22,720	-1010	- 4
09	181	615	857	4,940	7,380	+2440	+49

VARIANCE of ESTIMATE $S^2(\hat{Y}) = 19,504,600$

STANDARD ERROR of ESTIMATE $S(\hat{Y}) = 4,420$ PERSON DESTINATIONS

COEFFICIENT of MULTIPLE DETERMINATION $R^2 = 0.920$

	X_1	X_2	X_3	K
95 % CONFIDENCE RANGE	0.392	0.413	-3.905	+14,690
of EQUATION PARAMETERS	32.774	7.505	29.209	-33,670

Source: 50. Harper, B.C.S. and H.M. Edwards.
"Generation of Person Trips By Areas
Within the Central Business District",
Highway Research Board Bulletin 253
January 1960.

APPENDIX C-8
TRIP GENERATION RATES FROM STUDIES
OF SELECTED LAND DEVELOPMENT PROJECTS
IN CALIFORNIA

Source: 16. California Division of Highways
Continuing Project of Trip End
Generation Research.

TABLE 1

<u>APARTMENT COMPARISONS</u>										
<u>Site</u>	<u>Confi- dential</u>	<u>Confi- dential</u>	<u>Mission Heights</u>	<u>Chateau Manor</u>	<u>The Meadows</u>	<u>Shelter Bay</u>	<u>Harbor Vista</u>	<u>The Uplands</u>	<u>Camelback East</u>	<u>Avg.</u>
Study No.	81	82	83_	84	90	91	92	93	107	
<u>Background Data</u>										
Occupied Units	300	182	146	140	220	104	71	126	95	
Persons	550	350	300	380	468	137	110	400	182	
Persons Per Unit	1.8	1.9	2.1	2.7	2.1	1.3	1.5	3.2	1.9	2.1
Vehicles	400	200	196	247	320	---	90	230	141	
Vehicles Per Unit	1.3	1.1	1.3	1.7	1.5	---	1.3	1.8	1.5	1.4
Vehicles Per Person	.73	.57	.65	.64	.68	---	.82	.57	.77	.67
Acres	14.5	11.7	6.8	4.4	24.0	---	2.0	25.0	6.0	
Dwelling Units Per Acre	20.7	15.5	21.6	31.8	9.2	---	35.5	5.0	15.8	11.8
Parking Spaces	---	---	198	142	---	107	---	---	---	
10,000 Sq. Ft. Floor Area	---	---	---	---	---	15.6	---	18.0	8.6	
<u>Traffic Data</u>										
Average Weekday Traffic	2360	1280	1000	720	1290	680	340	900	660	
Peak Hour	5-6p	5-6p	5-6p	5-6p	4-5p	5-6p	6-7p	5-6p	5-6p	
Peak Hour % of AMDT	14.0%	13.3%	14.0%	11.1%	28.0%	11.8%	14.7%	11.1%	15.2%	15.3%
<u>Trip Ratios</u>										
Weekday Trips Per:										
Dwelling Unit	7.9	7.0	6.9	5.1	5.9	6.5	4.8	7.1	6.9	6.7
Person	4.3	3.7	3.3	1.9	2.8	5.0	3.1	2.3	3.6	3.2
Vehicle	5.9	6.4	5.1	2.9	4.0	---	3.8	3.9	4.7	4.7
Parking Space	---	---	5.0	5.1	---	6.4	---	---	---	
Acre	163	109	148	164	54	---	170	36	110	91
10,000 Sq. Ft. Floor Area	---	---	---	---	---	44	---	50	77	

TABLE 2

<u>Site</u>	<u>MOBILE HOME PARK COMPARISONS</u>					<u>Range of Ten Previous Studies</u>	<u>Avg.</u>
	<u>Adobe Wells</u>	<u>Confi- dential</u>	<u>Country Club</u>	<u>Town & Country</u>			
Study No.	85	99	108	109			
<u>Background Data</u>							
Number of Mobile Homes	300	153	192	175	20-328		
Persons	600	213	400	350	36-1000		
Persons Per Home	2.0	1.4	2.1	2.0	1.8-3.1	2.3	
Children	no	no	7	---			
Vehicles	525	201	230	250	29-600		
Vehicles Per Home	1.7	1.3	1.2	1.4	1.1-2.0	1.6	
Acres	75.0	13.0	17.0	22.5	1.3-33.0		
Dwelling Units Per Acre	4.0	11.8	11.3	8.0	7.6-16.0	8.1	
<u>Traffic Data</u>							
Average Weekday Traffic	1990	700	960	980	56-1704		
Peak Hour	7-8a	12-1p	5-6p	6-7p			
Peak Hour % of AWDT	10.5%	11.4%	11.5%	12.5%	9.8%-15.7%	11.5%	
<u>Trip Ratios</u>							
Weekday Trips Per:							
Dwelling Unit	6.6	4.6	5.0	5.6	2.8-6.8	5.5	
Person	3.3	3.3	2.4	2.8	1.6-3.4	2.5	
Vehicle	3.8	3.5	4.2	3.9	1.9-4.8	3.4	
Acre	27	54	57	44	42-85	46	

TABLE 3

<u>RETIREMENT COMMUNITY COMPARISONS</u>					
<u>Site</u>	<u>Wedgewood Manor</u>	<u>Valley Village</u>	<u>Sunny View</u>	<u>Confidential</u>	<u>Average</u>
Study No.	95	96	97	100	
<u>Background Data</u>					
Dwelling Units	108	300	76	3122	
Persons					
Residents	150	347	90	5463	
Residents Per Dwelling Unit	1.4	1.2	1.2	1.8	1.7
Staff	---	42	50	350	
Vehicles	101	95	55	3000	
Vehicles Per Dwelling Unit	---	---	---	---	.90
Floor Area 10,000 Sq. Ft.	---	21.1	5.5	---	
Acres	5.8	8.7	7.0	561.0	
Dwelling Units Per Acre	18.6	34.5	10.8	5.6	6.0
<u>Traffic Data</u>					
Average Weekday Traffic	310	830	260 ⁺	963 _J	
Peak Hour	11a-12p	8-9a	6-7p	4-5p	
Peak Hour % of AWDT	16.1%	12.1%	27.0%	11.1%	11.7%
<u>Trip Ratios</u>					
Weekday Trips Per:					
Dwelling Unit	2.9	2.8	3.4	3.1	3.1
Resident	2.1	2.1	1.9	1.7	1.8
Vehicle	3.1	8.7	4.7	3.2	3.4
Acre	53	95	37	17	19
10,000 Sq. Ft. Floor Area	---	39	47	---	

TABLE 5

HIGH SCHOOL COMPARISONS						
Site	Confi- dential	Ygnacio Valley High School	Previous Studies			Average
			Marin Catholic High School	Havenwood High School	Woodside High School	
Study No.	98	104	31	31	34	
<u>Background Data</u>						
Total Students	1203	2850	692	1285	2053	
By Bus	500	1200	---	146	625	
Staff	132	131	41	97	127	
Students Per Staff	9.1	21.7	16.8	13.2	16.1	15.4
Parking Spaces	501	321	225	259	393	
Acres of Parking	---	4.0	---	---	---	
10,000 Sq. Ft. Floor Area	16.5	20.0	28.4	11.7	11.0	
Acres	54.0	40.0	12.5	31.0	34.0	
<u>Traffic Data</u>						
Average Weekday Traffic	2580	3060	1230	1390	2250	
Peak Hour	7-8a	8-9a	8-9a	7-8a	8-9a	
Peak Hour % of AWDT	16.7%	26.8%	30.0%	20.0%	32.9%	24.8%
<u>Trip Ratios</u>						
Weekday Trips Per:						
Student	2.1	1.1	1.7	1.1	1.1	1.3
Staff	19.5	23.4	30.0	14.3	17.7	20.4
Parking Space	5.1	9.5	5.5	7.6	5.7	6.2
Acre of Parking	---	765	---	---	---	
10,000 Sq. Ft. Floor Area	156	153	43	119	204	119
Acre	48	77	98	45	66	62

TABLE 6

HOSPITAL COMPARISONS							
		Previous		Studies			
Site	Current	VA Martinez	Confidential				Avg.
Study No.	103	1B	5	18	22	30	
<u>Background Data</u>							
Total Beds	157	500	87	246	319	243	
Current Patients	142	484	52	192	244	160	
Fulltime Doctors	8	---	---	---	12	12	
Employees	422	690	129	500	415	410	
Employees Per Patient	2.9	1.4	2.5	2.6	3.2	2.6	2.5
Parking Spaces	265	500	96	335	400	280	
Parking Spaces Per Employee	.63	.72	1.80	.67	.91	.68	.73
Acres of Parking	4.0	---	---	---	11.1	---	
Floor Area 10,000 Sq. Ft.	8.0	---	---	---	11.0	---	
Acres	10.2	---	---	11.6		---	
<u>Traffic Data</u>							
Average Week Day Traffic	2340	2270	1510	3230		2510	
Peak Hour	3-4p	4-5p	3-4p	4-5p		2-3p	
Peak Hour % of AWDT	11.5%	18.0%	11.9%	9.9%		11.1%	11.4%
<u>Trip Ratios</u>							
Weekday Trips Per:							
Bed	14.9	4.5	13.2	12.3		9.5	10.4
Patient	16.5	3.1	22.3	15.8		14.4	12.7
Fulltime Doctor	292	---	---	---		209	285
Employee	5.5	2.2	9.0	6.1		5.6	5.5
Parking Space	8.8	3.0	12.1	9.0		8.2	7.6
Parking Acre	585	---	---	---		---	
10,000 Sq. Ft. Floor Area	293	---	---	---		---	
Acre	195	---	---	261		---	

TABLE 7

<u>Site</u>	<u>MEDICAL OFFICE COMPARISONS</u>				<u>Avg.</u>
	<u>Valley Center</u>	<u>Oak Grove</u>	<u>Health Associates</u>	<u>Stanford Med. Plaza</u>	
Study No.	105	112	42	43	
<u>Background Data</u>					
Doctors	20	14	7	54	
Employees	52	25	28	85	
Total Persons	72	39	35	139	
Parking Spaces	99	76	75	245	
10,000 Sq. Ft. Floor Area	2.0	2.0	1.0	3.9	
Acres	1.9	1.0	4.0	5.3	
<u>Traffic Data</u>					
Average Weekday Traffic	1035	450	440	1920	
Peak Hour	3-4p	2-3p	4-5p	4-5p	
Peak Hour % of AWDT	11.1%	15.0%	11.4%	16.7%	15.3%
<u>Trip Ratios</u>					
Weekday Trips Per:					
Doctor	51.7	31.2	53.4	35.5	40.5
Employee	19.9	18.0	13.4	22.6	20.2
Total Person	14.4	11.5	12.6	13.8	13.5
Parking Space	10.5	5.9	5.0	7.8	7.8
10,000 Sq. Ft. Floor Area	508	225	440	488	429
Acre	558	450	94	366	319
Acre of Parking	---	900	---	---	---

TABLE 8A

<u>Site</u>	<u>CURRENT INDUSTRIAL STUDIES</u>									<u>Avg.</u>
	<u>Granger Assoc.</u>	<u>Wall St. Jnrl.</u>	<u>Kaiser Aerosp.</u>	<u>Northgate Ind. Pk.</u>	<u>Confidential</u>	<u>Confidential</u>	<u>Confidential</u>	<u>Confidential</u>	<u>Confidential</u>	
Study No.	86	87	88	89	101	102	110	111	113	
<u>Background Data</u>										
Employees	280	139	548	574	152	372	120	413	100	
Floor Area 10,000 Sq. Ft.	6.4	5.8	10.6	29.1	8.9	19.5	4.0	9.8	8.5	
Floor Space Per Employee	228	417	193	508	585	524	332	237	850	
Acres	8.5	8.5	11.5	29.3	10.0	27.0	3.2	10.0	15.5	
Parking Spaces	324	150	423	---	200	350	100	292	80	
Parking Space Per Employee	1.15	1.08	.77	---	1.32	.94	.83	.71	.80	.90
Parking Area	---	---	---	---	---	---	1.2	4.0	0.5	
<u>Traffic Data</u>										
Average Weekday Traffic	1080	510	1220	4098	570	900	510	1200	440	
Peak Hour	7-8a	7-8a	7-8a	4-5p	7-8a	4-5p	7-8a	4-5p	4-5p	
Peak Hour % of AWDT	15.7%	13.7%	25.4%	11.5%	24.5%	25.6%	21.6%	23.4%	18.2%	17.6%
<u>Trip Ratios</u>										
Weekday Trips Per:										
Employee	3.9	3.7	2.2	7.1	3.8	2.4	4.3	2.9	4.4	3.9
10,000 Sq. Ft. Floor Area	169	88	115	141	64	46	127	122	52	103
Acre	127	60	106	140	57	33	159	120	28	85
Parking Space	3.3	3.4	2.9	---	2.8	2.6	5.1	4.1	5.5	3.2
Parking Acre	---	---	---	---	413	---	443	300	880	---

TABLE 8a

TYPES OF INDUSTRY

<u>Study No.</u>	<u>Name</u>	<u>Type</u>	<u>Location</u>	<u>C</u> <u>Ind.</u> <u>Pk.</u>	<u>D</u> <u>Ware-</u> <u>house</u>	<u>E</u> <u>Mass</u> <u>Prod.</u>	<u>F</u> <u>Adm.</u>	<u>G</u> <u>Res. &</u> <u>Dev.</u>	<u>H</u> <u>Spec-</u> <u>ialty</u>
20	PX	Grocery	San Lorenzo		X				
21	Westinghouse	Appliances	San Lorenzo		X				
25	Co-op Grocery	Grocery	El Cerrito		X				
27a	Crocker Industrial Park	Industrial Park	Brisbane	X					
27b	Dohrmann	Hotel Supplies	Brisbane		X	X			
27c	Warner Brothers	Lingerie	Brisbane		X				
29	Confidential	Chemical	Bay Area		X		X		
36	Confidential	Auto Assembly	Bay Area			X			
61	Ford	Auto Assembly	Milpitas			X			
67	Confidential	Chain Store	Bay Area				X		
68	U. S. Pipe	Pipe	Union City						X
69	Koeh	Luggage	Corte Madera		X	X			
72	Confidential	Glass Supply	Bay Area		X	X			
73	Hexcel	Insulation	Dublin				X	X	
74	Confidential	Food	Bay Area					X	
86	Granger	Electronics	Stanford					X	
87	Wall Street Journal	Printing	Stanford						X
88	Kaiser Aerospace	Defense	Stanford				X	X	X
89	Northgate	Industrial Park	San Rafael	X					
101	Confidential	Food Machine	Bay Area						X
102	Confidential	Defense	Bay Area					X	X
110	Confidential	Nuclear	Bay Area						X
111	Confidential	Data Processing	Bay Area				X	X	X
113	Confidential	Metal Accessory	Bay Area		X		X		

TABLE 8C

INDUSTRIAL PARK COMPARISONS

<u>Site</u>	<u>Crocker Industrial Park</u>	<u>Northgate Industrial Park</u>	<u>Average</u>
Study No.	27a	89	
<u>Background Data</u>			
Employees	960	574	
Vehicles	---	559	
10,000 Sq. Ft. Floor Area	121.8	29.1	
Acres	64.3	29.3	
<u>Traffic Data</u>			
Average Weekday Traffic	4350	4098	
Peak Hour	3-4p	4-5p	
Peak Hour % of AWDT	16.5%	11.5%	14.1%
% Trucks	14.4%	18.9%	
<u>Trip Ratios</u>			
Weekday Trips Per:			
Employee	4.5	7.1	5.5
10,000 Sq. Ft. Floor Area	36	141	56
Acre	68	140	90

TABLE 8D

<u>Site</u>	<u>WAREHOUSE COMPARISONS</u>									
	<u>Dohr-</u> <u>mann</u> <u>Hotel</u>	<u>Warner</u> <u>Bros.</u> <u>Lingerie</u>	<u>FX</u> <u>Groo.</u>	<u>Westing-</u> <u>House</u> <u>Elec. App.</u>	<u>Co-op</u> <u>Groo.</u>	<u>Koch</u> <u>Luggage</u>	<u>Conf.</u> <u>Glass</u>	<u>Conf.</u> <u>Metal</u>	<u>Conf.</u> <u>Chem.</u>	<u>Average</u>
Study No.	27b	27c	20	21	25	69	72	113	29	
<u>Background Data</u>										
Employees	290	30	47	250	28	200	129	100	305	
10,000 Sq. Ft. Floor Area	32.8	5.8	10.0	19.1	4.8	10.0	6.5	8.5	32.0	
Acres	13.2	4.5	4.3	5.0	4.3	4.7	10.0	15.5	15.0	
Parking Spaces	300	43	---	---	---	132	96	80	185	
Parking Space Per Employee	1.03	1.43	---	---	---	.66	.74	.80	.61	.79
<u>Traffic Data</u>										
Average Weekday Traffic	1300	225	494	1279	440	440	376	440	1220	
Peak Hour	7-8a	3-4p	7-8a	7-8a	8-9a	7-8a	6-7a	4-5p	7-8a	
Peak Hour % of AWDT	23.1%	26.8%	15.2%	13.5%	13.6%	25.2%	18.6%	18.2%	25.4%	19.9%
<u>Trip Ratios</u>										
Weekday Trips Per:										
Employee	4.5	7.5	10.5	5.1	15.7	2.2	2.9	4.4	4.0	4.5
10,000 Sq. Ft. Floor Area	40	39	49	67	92	44	58	52	39	48
Acre	99	50	115	256	102	95	38	28	82	81
Parking Space	4.3	5.2	---	---	---	3.4	3.9	5.5	6.6	4.8
Parking Acre	---	---	---	---	---	---	376	880	---	---

TABLE 8x

<u>MASS PRODUCTION COMPARISONS</u>						
<u>Site</u>	<u>Dohr- mann Hotel Supply</u>	<u>Confidential Assembly Plant</u>	<u>Ford Assembly Plant</u>	<u>Confidential Glass Fittings</u>	<u>Koch Luggage</u>	<u>Average</u>
Study No.	270	36	61	72	69	
<u>Background Data</u>						
Employees	290	5170	2260	129	200	
10,000 Sq. Ft. Floor Area	32.8	220.0	157.5	6.5	10.0	
Acres	13.2	75.6	44.5	10.0	4.7	
Parking Spaces	300	2200	2531	96	132	
Parking Spaces Per Employee	1.03	.43	1.12	.74	.66	.65
Parking Acres	---	25.2	17.0	---	---	
<u>Traffic Data</u>						
Average Weekday Traffic	1300	9660	8500	376	440	
Peak Hour	7-8a	6-7a	2-3p	6-7a	7-8a	
Peak Hour % of AWDT	23.1%	19.8%	18.0%	18.6%	25.2%	19.5%
<u>Trip Ratios</u>						
Weekday Trips Per:						
Employee	4.5	1.9	3.8	2.9	2.2	2.5
10,000 Sq. Ft. Floor Area	40	44	54	58	44	48
Acre	99	128	191	38	95	137
Parking Space	4.3	4.4	3.4	3.9	3.4	3.9
Parking Acre	---	384	500	376	---	

TABLE 8F

<u>Site</u>	<u>ADMINISTRATION COMPARISONS</u>						<u>Average</u>
	<u>Confidential Chem. Supp.</u>	<u>Hexcel Insulation</u>	<u>Kaiser Aerospace Engrs.</u>	<u>Confidential Data Proc.</u>	<u>Confidential Metal Acc.</u>	<u>Confidential Chain Store</u>	
Study No.	29	73	88	111	113	67	
<u>Background Data</u>							
Employees	305	180	548	413	100	80	
10,000 Sq. Ft. Floor Area	32.0	4.7	10.6	9.8	8.5	3.0	
Acres	15.0	14.0	11.5	10.0	15.5	1.2	
Parking Spaces	185	176	423	292	80	63	
Parking Space Per Employee	.61	.98	.77	.71	.80	.79	.75
Parking Acres	---	3.0	---	4.0	0.5	---	
<u>Traffic Data</u>							
Average Weekday Traffic	1220	436	1220	1200	440	282	
Peak Hour	7-8a	4-5p	7-8a	4-5p	4-5p	3-4p	
Peak Hour % of AWDT	25.4%	20.6%	25.4%	23.4%	18.2%	28.4%	24.0%
<u>Trip Ratios</u>							
Weekday Trips Per:							
Employee	4.0	2.4	2.2	2.9	4.4	3.5	3.0
10,000 Sq. Ft. Floor Area	39	95	115	122	52	94	70
Acre	82	31	106	120	28	229	71
Parking Space	6.6	2.5	2.9	4.1	5.5	4.5	3.9
Parking Acre	---	145	---	300	880	---	

TABLE 80

<u>INDUSTRIAL RES. & DEV. COMPARISONS</u>							
<u>Site</u>	<u>Hexcel Insul.</u>	<u>Confli- dential Food</u>	<u>Granger Elec.</u>	<u>Kaiser Aerosp. Engr.</u>	<u>Confli- dential Defense</u>	<u>Confli- dential Data Proc.</u>	<u>Average</u>
Study No.	73	74	86	88	102	111	
<u>Background Data</u>							
Employees	180	36	280	548	372	413	
10,000 Sq. Ft. Floor Area	4.7	4.5	6.4	10.6	19.5	9.8	
Acres	14.0	6.0	8.5	11.5	27.0	10.0	
Parking Spaces	176	50	324	423	350	292	
Parking Space Per Employee	.98	1.39	1.15	.77	.94	.71	.88
Acres Parking	3.0	.5	---	---	---	4.0	
<u>Traffic Data</u>							
Average Weekday Traffic	436	192	1080	1220	900	1200	
Peak Hour	4-5p	8-9a	7-8a	7-8a	4-5p	4-5p	
Peak Hour % of AWDT	20.6%	26.0%	15.7%	25.4%	25.6%	23.4%	22.5%
<u>Trip Ratios</u>							
Weekday Trips Per:							
Employee	2.4	5.3	3.9	2.2	2.4	2.9	2.7
10,000 Sq. Ft. Floor Area	95	43	169	115	46	122	91
Acre	31	32	127	106	33	120	65
Parking Space	2.5	3.8	3.3	2.9	2.6	4.1	3.1
Parking Acre	145	417	---	---	---	300	245

TABLE 8H

INDUSTRIAL SPECIALTY COMPARISONS								
<u>Site</u>	<u>U.S. Pipe & Foundry</u>	<u>Wall Street Journal</u>	<u>Kaiser Aerospace</u>	<u>Confi- dential Food Mach.</u>	<u>Confi- dential Defense</u>	<u>Confi- dential Nuclear</u>	<u>Confi- dential Data Proc.</u>	<u>Avg.</u>
Study No.	68	87	88	101	102	110	111	
<u>Background Data</u>								
Employees	155	139	548	152	372	120	413	
10,000 Sq. Ft. Floor Area	11.4	5.8	10.6	8.9	19.5	4.0	9.8	
Acres	70.4	8.5	11.5	10.0	27.0	3.2	10.0	
Parking Spaces	155	150	423	200	350	100	292	
Parking Space Per Employee	1.00	1.08	.77	1.32	.94	.83	.71	.88
Parking Acres	2.0	---	---	1.4	---	1.2	4.0	
<u>Traffic Data</u>								
Average Weekday Traffic	634	510	1220	570	900	510	1200	
Peak Hour	3-4p	8-9a	7-8a	4-5p	4-5p	7-8a	4-5p	
Peak Hour % of AWDT	14.2%	13.7%	25.4%	24.5%	25.6%	21.6%	23.4%	22.2%
<u>Trip Ratios</u>								
Weekday Trips Per:								
Employee	4.1	3.7	2.2	3.8	2.4	4.3	2.9	2.9
10,000 Sq. Ft. Floor Area	56	88	115	64	46	127	122	79
Acre	9	60	106	57	33	159	120	39
Parking Space	4.1	3.4	2.9	2.8	2.6	5.1	4.1	3.3
Parking Acre	328	---	---	413	---	443	300	344

APPENDIX C-9
SUMMARIES OF DATA
ON TRIP GENERATION AND MODE

COMPOSITION OF URBAN TRAVEL

TABLE 15
COMPOSITION OF PERSON-TRIPS BY TRAVEL-MODE FOR SELECTED CITIES

City	Year of Survey	Popu- lation (in 1000's)	% of Person Trips by			Passen- ger Trips per Auto Driver Trips
			Auto Driver	Passen- ger	Transit	
Albuquerque, N.M.	1949	116	53.3	33.1	13.6	0.62
Altoona, Pa.	1950	85	51.1	28.9	20.0	0.57
Appleton, Wis.	1953	39	63.8	30.5	5.7	0.48
Bay City, Mich.	1948	69	56.5	33.5	10.0	0.59
Chester, Pa.	1951	127	45.7	28.9	25.4	0.63
Dallas, Texas	1951	534	53.2	27.0	19.8	0.51
Duluth, Minn.						
Superior, Wis.	1948	131	43.5	29.6	26.9	0.68
Fargo, N. Dak.						
Moorhead, Minn.	1949	50	53.6	36.0	10.4	0.67
Houston, Tex.	1953	879	55.6	30.7	13.7	0.55
Johnston, Pa.	1949	88	40.4	22.3	37.3	0.55
Madison, Wis.	1949	104	50.9	26.8	22.3	0.53
Norfolk, Va.	1950	336	46.2	31.3	22.5	0.68
Norristown, Pa.	1949	39	49.2	25.5	25.3	0.52
Racine, Wis.	1949	78	55.9	26.3	17.8	0.47
Rockford, Ill.	1950	116	55.2	29.7	15.1	0.54
Sacramento, Cal.	1948	201	57.9	26.4	15.7	0.46
Saginaw, Mich.	1948	113	60.9	30.6	8.5	0.50
St. Paul-						
Minneapolis, Minn.	1949	916	48.0	25.6	26.4	0.53
Scranton, Pa.	1950	137	52.9	22.5	24.6	0.43
Sharon-Farrell, Pa.	1949	48	52.0	29.5	18.5	0.57
Tacoma, Wash.	1948	139	51.3	23.6	25.1	0.46
Tucson, Ariz.	1948	127	57.1	30.2	12.7	0.53
Washington, D.C.	1948	1110	36.7	24.0	39.3	0.65
Wichita, Kan.	1952	238	59.6	31.2	9.2	0.52
Williamsport, Pa.	1954	55	60.7	28.5	10.8	0.47
Wilmington, Del.	1948	181	38.9	26.6	34.5	0.68
Wisconsin Rapids, Wis.	1950	17	68.0	30.7	1.3	0.45
York, Pa.	1951	77	60.8	28.7	10.5	0.47
Mean		219.6	52.82	28.51	18.68	0.547
Standard Deviation		285.6	7.47	3.31	9.41	0.077

Source: F. B. Curran and J. T. Stegmaier, "Travel Patterns in 50 Cities," Highway Research Board Bulletin No. 203, pp. 100, 112-115.

TABLE 64
MEANS AND DISPERSION FOR TRAVEL AND RELATED VARIABLES

	Chicago		Detroit	
	Mean	Standard Deviation	Mean	Standard Deviation
<i>Sample Zones^a</i>				
Trips Per Occupied Dwelling Unit	7.06	1.89	6.19	1.80
Auto-Driver Trips Per Auto	3.53	0.74	3.41	0.86
Person Trips Per Trip-Maker	3.37	0.57	3.18	0.60
Car Ownership	1.09	0.25	0.98	0.25
CBD Distance	13.22	5.84	8.22	4.22
Average Number of Persons Per Dwelling Unit	3.52	0.45	3.49	0.43
Per Cent Persons Five and Over Making Trips	65.7	7.8	62.5	8.7
Median Tract Income Index	n.a.	n.a.	4.75	2.86
<i>All Zones Combined^b</i>				
Trips Per Occupied Dwelling Unit	6.60	2.39	5.88	1.99
Auto-Driver Trips Per Auto	3.32	0.98	3.31	0.91
Person Trips Per Trip-Maker	3.22	0.69	3.09	0.65
Car Ownership	1.05	0.34	0.93	0.31
CBD Distance	13.82	7.29	7.80	4.39
Average Number of Persons Per Dwelling Unit	3.46	0.72	3.38	0.61
Per Cent Persons Five and Over Making Trips	65.5	12.2	62.1	9.8
Median Tract Income Index	n.a.	n.a.	4.32	2.98

^a Refers to 344 traffic analysis zones in Chicago and 446 census tracts in Detroit.

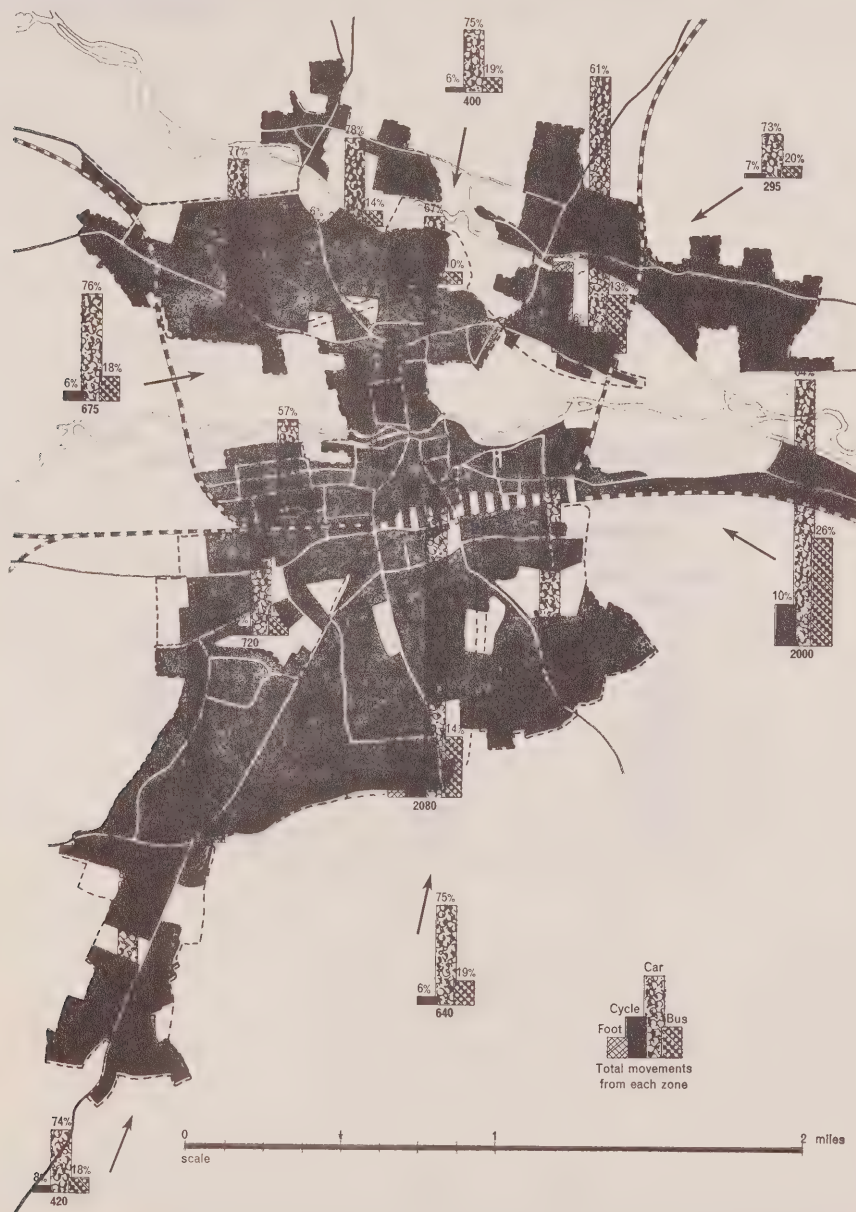
^b Refers to 537 traffic analysis zones in Chicago and 528 census tracts in Detroit.

PERCENTAGE DISTRIBUTION OF TRIPS BY PASSENGER CARS
CLASSIFIED BY ONE-WAY LENGTH OF TRIP AND BY SIZE OF CITY

One-Way Trip Length		Percent of Trips for Cities With Population of			
Miles	Average In Class	Under 5,000	5,000- 24,999	25,000- 99,999	100,000 and over
Under 5	1.9	65.0	71.4	71.1	57.5
5-9	6.5	12.2	11.5	14.0	24.9
10-14	11.6	7.5	5.4	5.9	7.9
15-19	16.6	4.9	3.4	2.4	3.1
20-29	23.5	4.4	3.5	2.4	2.9
30-39	33.4	2.0	1.8	1.2	1.3
40-49	43.7	1.4	0.7	0.7	0.6
50-99	67.6	1.7	1.4	1.3	1.1
100-and over	219.0	0.9	0.9	1.0	0.7
Total		100.0	100.0	100.0	100.0
<hr/>					
Average Length All Trips in Miles	8.4	8.6	7.7	7.8	7.8
<hr/>					

Source: 91. Oi, Walter Y. and Paul W. Shuldiner.
An Analysis of Urban Travel Demands,
Third Printing, Northwestern University
Press, Chicago, Illinois, 1967.

APPENDIX C-10
DATA ON TRIP MODE FOR NEWBURY, GREAT BRITAIN



77 Mode of travel for the journey to work from each residential zone in year 2010 including residential zones outside the city (indicated by arrows).

Source: 15. Buchanan, Colin, "Traffic in Towns"
Her Majesty's Stationery Office
London, England 1963.

APPENDIX C-11
DATA ON TRIP GENERATION RATES
RELATED TO OCCUPATION

TABLE 1
AVERAGE TRIPS PER HOUSEHOLD CLASSIFIED BY
OCCUPATION OF HEAD OF HOUSEHOLD

Occupation	Avg. Trips per Household	
	Stowers' CATS Data, 1956	PSRTS Data, 1961
Professional	7.07	7.11
Manager	7.29	7.35
Clerical	4.90	5.40
Sales	7.40	6.59
Craftsman	5.70	7.13
Operative	5.04	6.76
Service	4.80	5.86
Laborer	4.61	5.74
Unemployed	4.47	6.43

TABLE 2
TRIP PRODUCTION BY OCCUPATION AND SIZE OF FAMILY FOR ONE-CAR HOUSEHOLDS

Occupation of Head of Household	Trips per Household					
	CATS 1956 (Stowers)					
	1 Person	2 Persons	3 Persons	4 Persons	5 Persons	≥ 6 Persons
Professional	3.58	5.52	6.69	7.88	8.22	13.30
Manager	3.00	5.19	6.84	7.36	6.53	8.32
Sales	3.83	7.19	6.32	8.52	9.71	8.50
Craftsman	2.45	4.29	5.24	5.74	6.73	7.95
Operative	2.35	4.33	5.09	5.28	6.01	7.37
Clerical	3.23	4.57	5.40	6.61	6.91	8.19
Service	3.15	4.53	5.96	6.08	6.11	8.15
Laborer	2.00 ^a	3.79	4.83	6.41	4.80	7.83

^aRepresents fewer than 10 observations.

PSRTS 1961						
	1 Person	2 Persons	3 Persons	4 Persons	5 Persons	≥ 6 Persons
	4.51	7.02	8.25	9.15	11.37	12.18
	5.09	6.79	9.43	10.01	12.49	13.05
	5.25	7.61	10.69	10.58	11.90	12.04
	3.73	6.11	7.72	9.34	10.56	12.25
	3.70	6.49	7.44	9.30	10.24	10.33
	3.87	6.94	8.30	9.60	11.17	12.90
	3.53	6.16	9.36	9.15	8.55	13.26
	3.21	5.32	7.64	8.08	9.25	9.80

Source: 125. Walker, John R., "Social Status of Head of Household and Trip Generation from Home", Highway Research Record No. 114 1966.

APPENDIX C-12
DATA ON TRIP GENERATION RATES
FOR SUBURBAN INDUSTRIAL DEVELOPMENTS

TABLE 4
RELATIONSHIP OF EMPLOYMENT TO OCCUPIED AND AVAILABLE
PARKING SPACES

Total Number of Employees	Number of Spaces Occupied	Number of Occupied Spaces per Employee	Number of Available Spaces	Percent of Available Spaces Occupied
0-100				
20	14	0.70	25	56
33	18	0.55	23	78
50	27	0.54	57	47
70	42	0.60	50	84
75	22	0.29	35	63
75	47	0.63	46	102
85	34	0.40	70	49
92	52	0.57	65	80
		Average	0.54	
100-500				
120	76	0.63	68	112
130	103	0.79	134	77
193	122	0.63	175	70
240	71	0.30	132	54
240	141	0.59	187	75
400	182	0.45	265	69
465	175	0.38	209	84
		Average	0.54	
Over 500				
824	370	0.45	493	75
850	424	0.50	466	91
1000	679	0.68	763	89
		Average	0.54	
		Total Mean	0.54	
		Standard deviation	0.133	

TABLE 7
INDUSTRIAL AUTO TRAFFIC GENERATION CHARACTERISTICS

Factor	Average Morning Volume Generated			Average Evening Volume Generated		
	Peak 30 Min.	Peak Hour	Peak 2 Hours	Peak 30 Min.	Peak Hour	Peak 2 Hours
Developed land area (sq ft)	(per 10,000 sq ft)			(per 10,000 sq ft)		
0-100,000	3.0	4.5	6.0	3.8	5.3	6.7
100,000-500,000	2.5	3.9	5.2	1.7	2.8	4.2
Over 500,000	1.8	2.9	3.9	2.4	3.8	5.1
Total Mean	2.4	3.8	5.2	2.6	4.1	5.5
Building area (sq ft)	(per 10,000 sq ft)			(per 10,000 sq ft)		
0-30,000	10.5	15.6	19.4	10.4	15.6	20.8
30,000-100,000	6.2	8.6	11.5	6.3	7.5	9.8
Over 100,000	4.4	7.5	9.8	4.9	8.4	11.4
Total Mean	6.5	10.0	12.8	6.7	10.1	13.5
Employment	(per employee)			(per employee)		
0-100	0.17	0.25	0.35	0.20	0.31	0.39
100-500	0.24	0.37	0.48	0.20	0.31	0.47
Over 500	0.19	0.32	0.42	0.25	0.42	0.55
Total Mean	0.21	0.32	0.42	0.22	0.34	0.46

"The best correlation appears to be generation related to employment".

Source: 3. Alroth, Willard A., "Parking and Traffic Characteristics of Suburban Industrial Developments", Highway Research Record No. 237 1968.

APPENDIX C-13
DATA ON TRIP GENERATION AND MODE
FROM A LARGE APARTMENT IN TORONTO

Specific surveys were carried out at a large apartment complex near the Eglinton Avenue subway station in Toronto. A summary of the data follows:

TABLE 1
TOTAL DAILY TRIPS GENERATED
BETWEEN HOME AND DESTINATION PURPOSES

	Purpose of Destination		
	Work	Business	Pleasure
By Residents	1.59	0.22	0.67
Per Apartment	2.87	0.40	1.20

TABLE 2
PEAK HOUR TRIPS GENERATED
BETWEEN HOME AND DESTINATION PURPOSES

	Purpose of Destination		
	Work	Business	Pleasure
By Residents	0.49	Not Significant	
Per Apartment	0.89	Not Significant	

TABLE 3

MODE OF TRAVEL
BETWEEN HOME AND DESTINATION PURPOSES
EXPRESSED AS PERCENT OF TOTAL DAILY TRIPS

Mode	Purpose of Destination		
	Work	Business	Pleasure
Auto Driver	27	31	47
Auto Passenger	3	7	27
Taxi Passenger	1	--	2
Subway	45	17	11
Bus	11	--	2
Walk	13	45	11

TABLE 4

MODE OF TRAVEL
BETWEEN HOME AND WORK
EXPRESSED AS PERCENT OF PEAK HOUR TRIPS

Mode	
Auto Driver	24
Auto Passenger	2
Taxi Passenger	1
Subway	51
Bus	9
Walk	13

Source: 29. De Leuw, Cather, Project M3, Assessment of Roads, Transit, Service and Parking for the Marathon Realty Company Ltd. August 1968.

APPENDIX C-14
 DATA ON TRANSIT TRIP GENERATION
 FOR PITTSBURGH

TABLE 1
 DISTRIBUTION OF TRANSIT TRIPS

Trip	Amount	Percent	Percent of Total Internal Survey Trips in This Category by All Modes
CBD	155,563	32.8	56.5
School	152,559	32.2	64.1
Other	165,628	35.0	9.7
Total	473,750	100.0	21.7

TABLE 2A
 TRANSIT TRIPS PER CAPITA BY CAR OWNERSHIP GROUP

Autos per Household	Transit Trips per Capita	Percent of Total Internal Person Trips
0	0.74	64.3
1	0.30	17.6
2	0.26	10.8
Over-all	0.32	21.7

TABLE 2B
 TRANSIT TRIPS PER CAPITA BY DENSITY CLASS

Net Residential Density (persons per acre)	Transit Trips per Capita
0 - 14.9	0.36
15 - 29.9	0.32
30 - 59.9	0.32
60 - and over	0.31
Over-all	0.32

TABLE 7
TRANSIT TRIPS—BLOCKS WALKED RELATED TO AUTOS OWNED AND
DRIVER/NON-DRIVER

Cars per Household	Driver/Non-Driver	Average Total Blocks Walked *
0	Driver	2.57
0	Non-driver	2.46
1	Driver	2.73
1	Non-driver	2.02
2 or more	Driver	2.61
2 or more	Non-driver	1.66
All trips		2.30

* Time: 7 to 8 minutes

PERCENT OF CBD TRIPS BY TRANSIT

Autos per Household	Zones Under 1 Mi from CBD	Zones Over 1 Mi ** NRD 12 or More	From CBD NRD Under 12
0	77.0	88.0	61.0
1	35.5	53.5	36.0
2 or more	13.5	31.5	20.5

** Net residential density

Source: 101. Schwartz, Arthur, "Forecasting Transit Use",
Highway Research Board Bulletin 297
January 1961.

APPENDIX C-15
DATA ON TRIP GENERATION
AND OCCUPATION OF TRANSIT RIDERS

TABLE 2
GENERATION OF TRAVEL BY URBAN RESIDENTS¹

Area	Year of Survey	Population in Study Area	Trips per Person	Persons per Car	Trips per Dwelling	Persons per Dwelling	Cars per Dwelling
Chicago, Ill.	1956	5,169,663	1.92	3.85	5.96	3.10	0.80
Detroit, Mich.	1953	2,968,875	1.77	3.51	5.88	3.31	0.94
Washington, D. C.	1955	1,568,522	1.67	3.75	5.05	3.02	0.81
Pittsburgh, Pa.	1958	1,472,099	1.61	3.75	5.26	3.26	0.87
St. Louis, Mo.	1957	1,275,454	1.94	3.48	6.05	3.12	0.90
Houston, Texas	1953	878,629	2.22	3.43	7.16	3.22	0.94
Kansas City, Mo.	1957	857,550	2.18	3.26	6.69	3.07	0.95
Phoenix, Ariz.	1957	397,395	2.29	2.87	6.88	3.01	1.05
Nashville, Tenn.	1959	357,585	2.29	3.35	7.52	3.28	0.98
Chattanooga, Tenn.	1960	242,000	2.17	3.32	7.22	3.33	1.00
Ft. Lauderdale, Fla.	1959	210,850	1.69	2.72	3.63	2.15	0.79
Charlotte, N. C.	1958	202,272	2.36	3.28	8.10	3.43	1.05
Reno, Nev.	1955	54,933	2.48	2.43	6.87	2.77	1.14

¹Compiled from various summaries of origin-destination data for each urban area.

TABLE 6
OCCUPATION OF TRANSIT RIDERS, CHATTANOOGA, TENNESSEE¹
(1960 Average Weekday)

Occupation	Central Business District Trips		Non-Central Business District Trips		Total-All Metropolitan Area Trips	
	Total	% ²	Total	%	Total	%
Professional and semi-professional	562	4.7	413	2.4	975	3.3
Proprietors, managers, and officials	360	3.0	265	1.5	625	2.1
Store and office clerks, inside salesmen, etc.	3,040	25.3 ^a	1,263	7.3	4,303	14.7
Traveling salesmen, agents, canvassers, etc.	53	0.4	95	0.6	148	0.5
Craftsmen, foremen, skilled laborers, etc.	276	2.3 ^b	710	4.1	986	3.4
Operatives and semi-skilled workers	996	8.3	2,682	15.5	3,678	12.6
Laborers and unskilled workers	679	5.7	1,484	8.6	2,163	7.4
Protective services, policemen, etc.	42	0.3	42	0.2	84	0.3
Personal service workers	1,250	10.4	5,301	30.7	6,551	22.3
Housewives and retired persons	3,168	26.3	1,688	9.8	4,856	16.6
High school and grammar school students	1,313	10.9	3,086	17.9	4,399	15.0
College and business school students	286	2.4	244	1.4	530	1.8
Total trip destinations	12,025	100.0	17,273	100.0	29,298	100.0

¹Source: Transportation Program—Chattanooga, Tennessee, Wilbur Smith and Associates, 1961. Excludes school bus trips.

²Because the data were obtained from an approximate 5 percent sample, they are subject to some sampling variability. The following two examples illustrate this variability:

^aApproximate 95 percent confidence limits are 22.9 and 28.7 percent. ^bApproximate 95 percent confidence limits are 0.7 and 4.9 percent.

Source: 74. Levinson, Herbert S. and F. Houston Wynn.
"Some Aspects of Future Transportation in
Urban Areas", Highway Research Board Bulletin 326
1962.

APPENDIX C-16 .
SUMMARIES OF INTERNAL PERSON TRIPS
BY MAJOR PURPOSES

To From	Home	Work	Personal Business	Social Recreation	Change Mode	Eat Meal	Serve Passenger	Shop Regional	Shop Local	Shop Other	School	Total
Home	—	11.65	3.33	12.75	0.29	0.32	2.46			6.70	0.46	37.98
Work	10.60	2.74	0.73	0.30	0.16	3.43	0.67			0.26	—	18.89
Personal Business	3.00	0.55	0.92	0.45	0.01	0.16	0.12			0.40	—	5.61
Social Recreation	13.55	0.14	0.14	2.28	0.08	0.74	0.55			0.32	0.01	17.81
Change Mode	0.29	0.15	0.01	0.10	0.06	0.05	—			0.03	—	0.69
Eat Meal	0.45	3.06	0.17	0.65	0.01	—	0.18			0.09	0.25	4.86
Serve Passenger	2.46	0.66	0.13	0.42	—	0.10	0.67			0.18	0.01	4.63
Shop Regional												
Shop Local												
Shop Other	6.65	0.13	0.20	0.59	0.07	0.09	0.17			0.90	0.01	8.81
School	0.44	0.01	0.01	0.03	—	0.26	0.03			0.01	—	0.79
Total	37.46	19.09	5.64	17.57	0.68	5.15	4.85			8.89	0.74	100.07

100

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BY PURPOSE (TEN CLASSIFICATIONS)
CITY OF BARRIE, ONTARIO 1961

To From	Home	Work	Business			Social Recreation	Total						
			Personal	Shop	School								
Home	—	15.0	3.6	7.3	0.5	14.3	40.7						
Work	15.0	2.9	1.4	0.3	—	1.2	20.8						
Business	Personal	3.7	1.3	1.5	0.4	—	0.4	7.3					
	Shop	7.4	0.1	0.2	1.0	—	0.7	9.4					
	School	0.6	—	—	—	—	0.3	0.9					
Social Recreation	15.0	1.1	0.2	0.4	0.2	4.0	20.9						
Total	41.7	20.4	6.9	9.4	0.7	20.9	100.0						

PERCENT OF TOTAL INTERNAL PERSON TRIPS

BY PURPOSE (FOUR CLASSIFICATIONS)

CITY OF BARRIE, ONTARIO 1961

To From	Home	Work	Business	Pleasure	Total							
Home	—	30.0	23.1	29.3	82.4							
Work		2.9	3.1	2.3	8.3							
Business			3.1	2.2	5.3							
Pleasure				4.0	4.0							
Total					100.0							

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BETWEEN ORIGIN AND DESTINATION PURPOSES
CITY OF BARRIE, ONTARIO 1961

To From	Home	Work	Personal Business	Social Personal	Change Mode	Eat Meal	Serve Passenger	Shop Regional	Shop Local	Shop Local	School	Total
Home	—	17.68	5.02	6.38						4.91	4.71	39.70
Work	16.20	9.34	1.17	0.79						0.77	0.15	28.42
Personal Business	6.00	0.73	0.93	0.68						0.55	0.06	8.95
Social Personal	7.60	0.22	0.38	1.53						0.59	0.03	10.35
Change Mode												
Eat Meal												
Serve Passenger												
Shop Regional												
Shop Local												
Shop Local	5.65	0.31	0.34	0.68						1.03	0.02	8.03
School	4.10	0.06	0.20	0.20						0.06	0.10	4.72
Total	39.55	28.34	9.04	10.26						7.91	5.07	100.17

100

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BY PURPOSES (SIX CLASSIFICATIONS)
CITY OF ADELAIDE, AUSTRALIA 1961

Note: Trips made for recreational purposes are included with Personal
Business Trips

To From	Home	Work	Business			Social	Total						
			Personal	Shop	School								
Home	—	17.7	6.0	4.9	4.7	6.4	39.7						
Work	16.2	9.3	1.2	0.8	0.1	0.8	28.4						
Business	Personal	6.0	0.7	0.9	0.5	0.1	0.7	8.9					
	Shop	5.6	0.3	0.3	1.0	—	0.7	7.9					
	School	4.1	0.1	0.2	0.1	—	0.2	4.7					
Social	7.6	0.2	0.4	0.6	0.1	1.5	10.4						
Total	39.5	28.3	9.0	7.9	5.0	10.3	100						

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BY PURPOSE (FOUR CLASSIFICATIONS)
CITY OF ADELAIDE, AUSTRALIA 1965

Note: Trips made for recreational purposes are included with Personal Business Trips

To From	Home	Work	Recreation	Social	Total							
Home	—	33.9	31.3	14.0	79.2							
Work		9.3	3.2	1.0	13.5							
Recreation			3.1	2.7	5.8							
Social				1.5	1.5							
Total					100.0							

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BETWEEN ORIGIN AND DESTINATION PURPOSES
CITY OF ADELAIDE, AUSTRALIA 1965

Note: Trips made for recreational purposes are included with Personal
Business Trips

To From	Home	Work	Personal Business	Social Recreation	Change Mode	Eat Meal	Serve Passenger	Shop Regional	Shop Local	Shop Other	School	Total
Home	—	9.92	4.13	8.76	0.35	1.12	5.00			5.30	3.32	37.90
Work	8.96	3.55	0.52	0.42	0.10	1.27	0.76			0.64	0.02	16.24
Personal Business	3.62	0.36	0.79	0.46	0.01	0.08	0.31			0.81	0.06	6.50
Social Recreation	9.60	0.15	0.24	2.08	0.04	0.17	0.60			0.67	0.04	13.59
Change Mode	0.27	0.11	0.03	0.02	—	0.01	0.01			0.02	0.16	0.63
Eat Meal	0.98	1.10	0.10	0.34	—	—	0.15			0.11	0.21	2.99
Serve Passenger	4.16	1.06	0.43	0.55	0.01	0.15	1.63			0.62	0.08	8.69
Shop Regional												
Shop Local												
Shop Other	6.77	0.14	0.39	0.61	—	0.09	0.32			1.67	0.03	10.03
School	2.66	0.05	0.10	0.15	0.12	0.19	0.09			0.09	0.10	3.55
Total	37.02	16.44	6.73	13.39	0.63	3.08	8.87			9.93	4.02	100.12 ✓

100

PERCENT OF TOTAL INTERNAL PERSON TRIPS
 BY PURPOSE (NINE CLASSIFICATIONS)
 CITY OF MADISON, WISCONSIN 1962

To From	Home	Work	Business			Social Recreation	Total						
			Personal	Shop	School								
Home	—	12.2	4.9	6.3	4.0	11.6	39.2						
Work	12.5	3.9	1.7	0.7	—	0.8	19.6						
Business	Personal	4.4	1.7	1.3	0.9	—	0.5	8.8					
	Shop	7.5	0.1	0.4	1.9	—	0.8	11.4					
	School	3.9	0.1	0.1	0.1	0.1	0.4	4.0					
Social Recreation	12.0	0.2	0.2	0.9	0.2	2.9	17.0						
Total	40.3	18.2	8.6	11.0	4.3	17.0	100.0						

PERCENT OF TOTAL INTERNAL PERSON TRIPS

BY PURPOSE (FOUR CLASSIFICATIONS)

CITY OF MADISON, WISCONSIN 1962

To From	Home	Work	Business	Pleasure	Total								
Home	—	24.7	31.2	24.2	80.1								
Work		3.9	4.3	1.0	9.2								
Business			4.8	3.0	7.8								
Pleasure				2.9	2.9								
Total					100.0								

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BETWEEN ORIGIN AND DESTINATION PURPOSES
CITY OF MADISON, WISCONSIN 1962

To From	Home	Work	Personal Business	Social Recreation	Change Mode	Eat Meal	Serve Passenger	Shop Regional	Shop Local	Shop Other	School	Total
Home	—	16.71	9.10	5.72		0.32				6.23	5.55	43.63
Work	16.00	3.21	0.56	0.25		0.60				0.39	0.04	21.05
Personal Business	8.92	0.36	1.71	0.46		0.10				0.67	0.03	12.25
Social Recreation	6.28	0.06	0.29	0.91		0.09				0.26	0.02	7.91
Change Mode												
Eat Meal	0.42	0.53	0.07	0.07		—				0.03	0.10	1.22
Serve Passenger												
Shop Regional												
Shop Local												
Shop Other	6.75	0.09	0.40	0.38		0.03				0.83	0.01	8.49
School	4.89	0.05	0.13	0.13		0.11				0.04	0.04	5.39
Total	43.26	21.01	12.26	7.92		1.25				8.45	5.79	99.94

100

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BY PURPOSE (SEVEN CLASSIFICATIONS)
CITY OF PITTSBURGH, PENNSYLVANIA 1958

To From	Home	Work	Business			Social Recreation	Total						
			Personal	Shop	School								
Home	—	16.7	9.1	6.2	5.6	6.0	43.6						
Work	16.0	3.2	1.1	0.4	—	0.4	21.1						
Business	Personal	8.9	0.9	1.9	0.7	—	0.6	13.0					
	Shop	6.6	0.1	0.4	0.8	—	0.4	8.5					
	School	4.9	0.1	0.1	—	—	0.2	5.3					
Social Recreation	6.7	0.1	0.3	0.3	0.1	1.0	8.5						
Total	43.3	21.1	12.9	8.4	5.7	8.6	100.0						

PERCENT OF TOTAL INTERNAL PERSON TRIPS

BY SIMPLIFIED PURPOSE (FOUR CLASSIFICATIONS)

CITY OF PITTSBURGH, PENNSYLVANIA 1958

To From	Home	Work	Business	Pleasure	Total							
Home	—	32.7	41.5	12.7	86.9							
Work		3.2	2.6	0.5	6.3							
Business			3.9	1.9	5.8							
Pleasure				1.0	1.0							
Total					100.0							

PERCENT OF TOTAL INTERNAL PERSON TRIPS
BETWEEN ORIGIN AND DESTINATION PURPOSES
CITY OF PITTSBURGH, PENNSYLVANIA 1958

APPENDIX D

APPENDIX D

TRIP DISTRIBUTION

Through experience or intuition certain functions can be identified that influence travel patterns. These functions can be analyzed in relationship to observed travel and then hopefully certain generalizations can be made in order to predict or estimate the expected travel for a known set of conditions.

1) Population Characteristics

It is likely that the extent and type of travel is affected by the population characteristics. Certain groups of people will be inclined to make more trips for particular purposes by a specific mode than will other groups. For example the employment-population ratio will affect the number of work trips and, the number of young and old people will influence the patronage and necessity of mass transit.

2) Accessibility

Accessibility has a significant effect on the number of trips that would be made to an area. Irrespective of the attractiveness of an area, if it is next to impossible to get there, a very small amount of trips would be made to it. It is also expected that for certain trip purposes accessibility would be of a greater importance than for others. Local shopping trips would be significantly affected by travel time whereas social-recreation trips would be less affected by travel time.

3) Intensity

The characteristics of the destination area have a direct effect on the number of trips made to that area. The greater the intensity or activity (employment opportunities, sales,

number of night clubs, etc.) the more trips that would be expected to go there.

4) Compatibility

It is expected that the travel that is made is between areas of compatible desires. Heavy industry work trips would be made between the likely locations where manufacturing employees would live and the industry concentrations. It is very unlikely that a significant number of trips would be made from the upper income residential locations.

5) Mobility

Mobility includes the opportunities that a person has for travel (economic level, car ownership, etc.) and also on the type of facilities that are provided for his use - level of mass transit service, quality of the highway system etc. Mobility will affect the frequency and distribution of travel.

In Appendices D-1 and D-2 accessibility and intensity were investigated in greater detail for a particular set of population characteristics, compatibility and mobility.

APPENDIX D-1

TRAVEL DISTRIBUTION FOR AN EMPLOYMENT AREA

An industrial zone was selected in Erie, Pa., and the travel pattern distribution by distance between the zone and the residential areas in Erie was compared with the population distribution by distance. Since it was expected that all groups of people would not be working in the industrial zone, the population distribution was separated in economic levels. Car ownership was used as the indicator of the economic level. The car ownership varied from 0.23 to 0.46 cars per person.

Cumulative percentage of trips to and from the industrial area (zone 40) has been plotted (see page 3) in one mile distance increments from the zone. For the same increments the population distribution has been plotted in levels of increasing cars per person ratios.

From the graph it can be seen that the trip curve accumulates at a much faster rate than any of the population curves. This indicates that competition and distance (travel time) has a significant effect on the travel pattern. If there were no competition the trip curve would be identical to one of the population curves. Since there is competition it is expected that the travel pattern is affected by some function of time. Other considerations could also affect the travel such as subjective reasons for preferring one employment area over another but for now it is assumed that they are not significant. The first estimate that has been made for the effect of time is an inverse distance relationship. For the case of comparing graphs the population distributions have been adjusted on an inverse distance basis and have been plotted

for cumulative car ownership levels of 0.33, 0.37 and 0.46 cars per person (total population). In this particular case the economic level does not have a significant effect on the trip distribution. The best fit was obtained for the total population i.e. cumulative car ownership level of 0.46 cars per person. It appears that for work trips for a city the size of Erie, population 178,000 the trips appear to be distributed on an inverse distance (time) basis. Tables 2, 3, and 4; and graphs 2 and 3 show the calculations and plots of the comparisons. A flow diagram is shown on page 9 indicating the percentage of total residential trip ends and the travel time to the industrial zone.

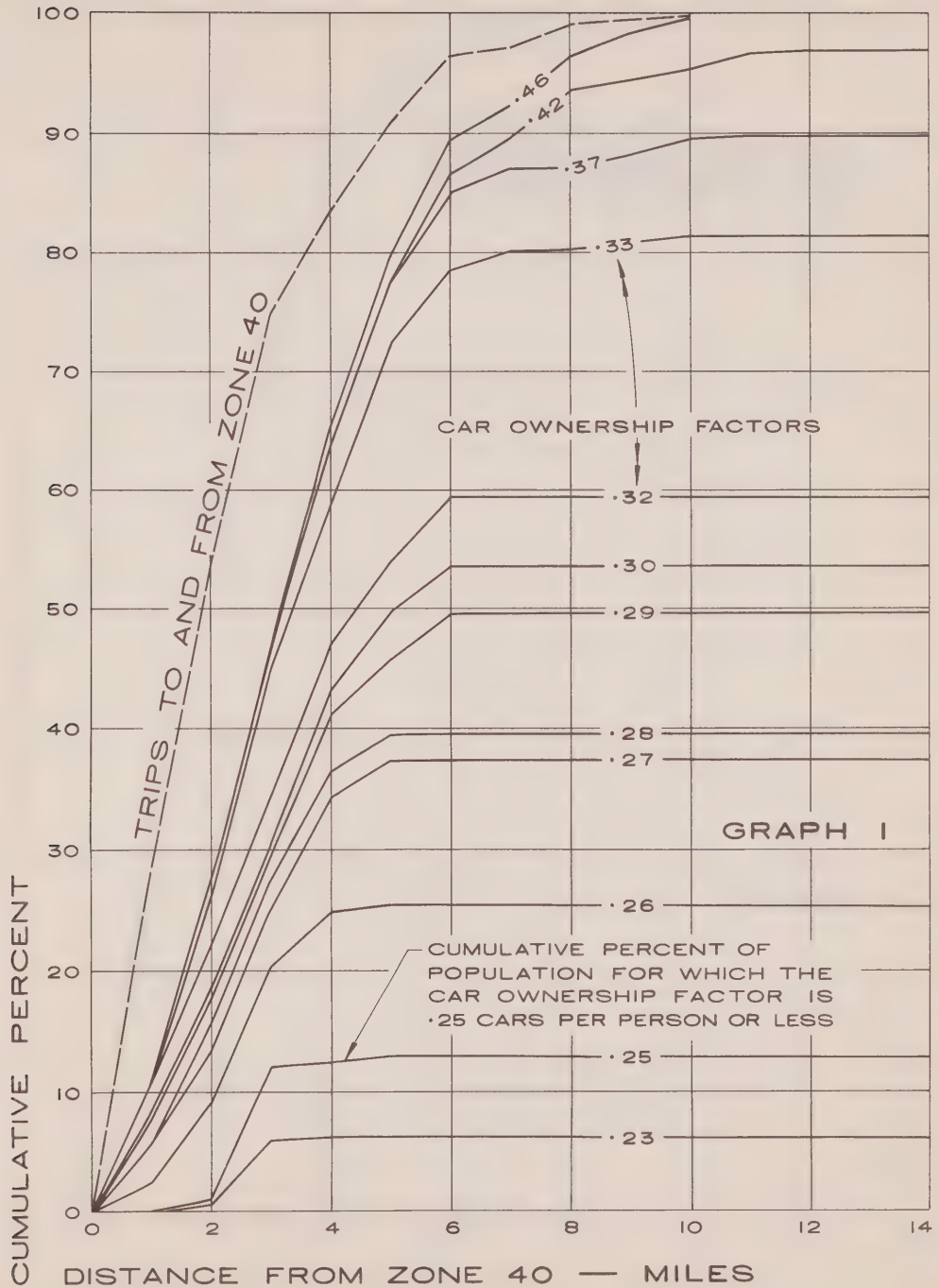
Further Investigations of Time Functions

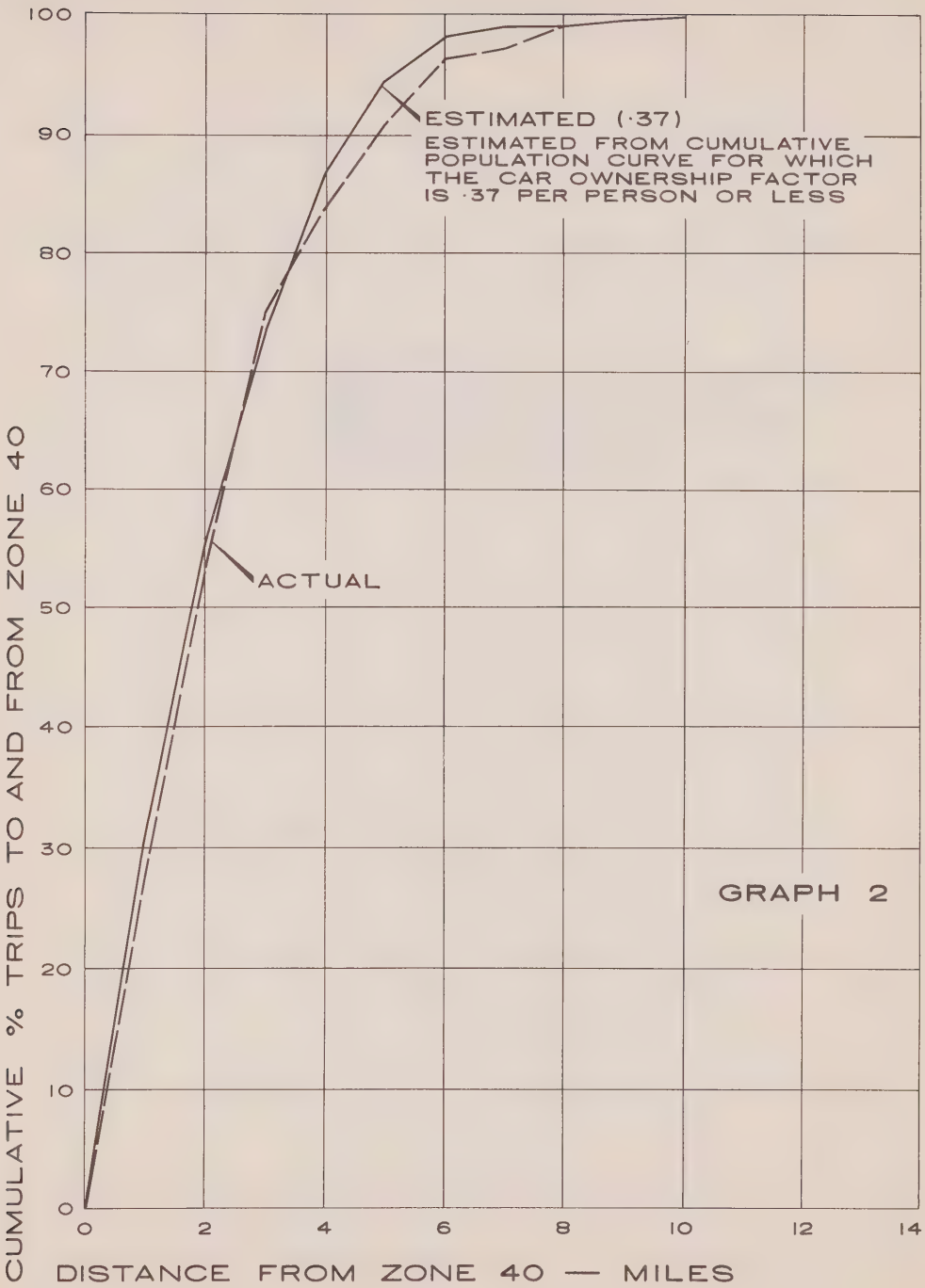
The preceding outline has been made for one particular industrial area in Erie, for one specific trip purpose. Similar investigations can be made for other locations and also for other purposes. Hopefully trends could be observed and generalized curves obtained.

Effect of Intensity

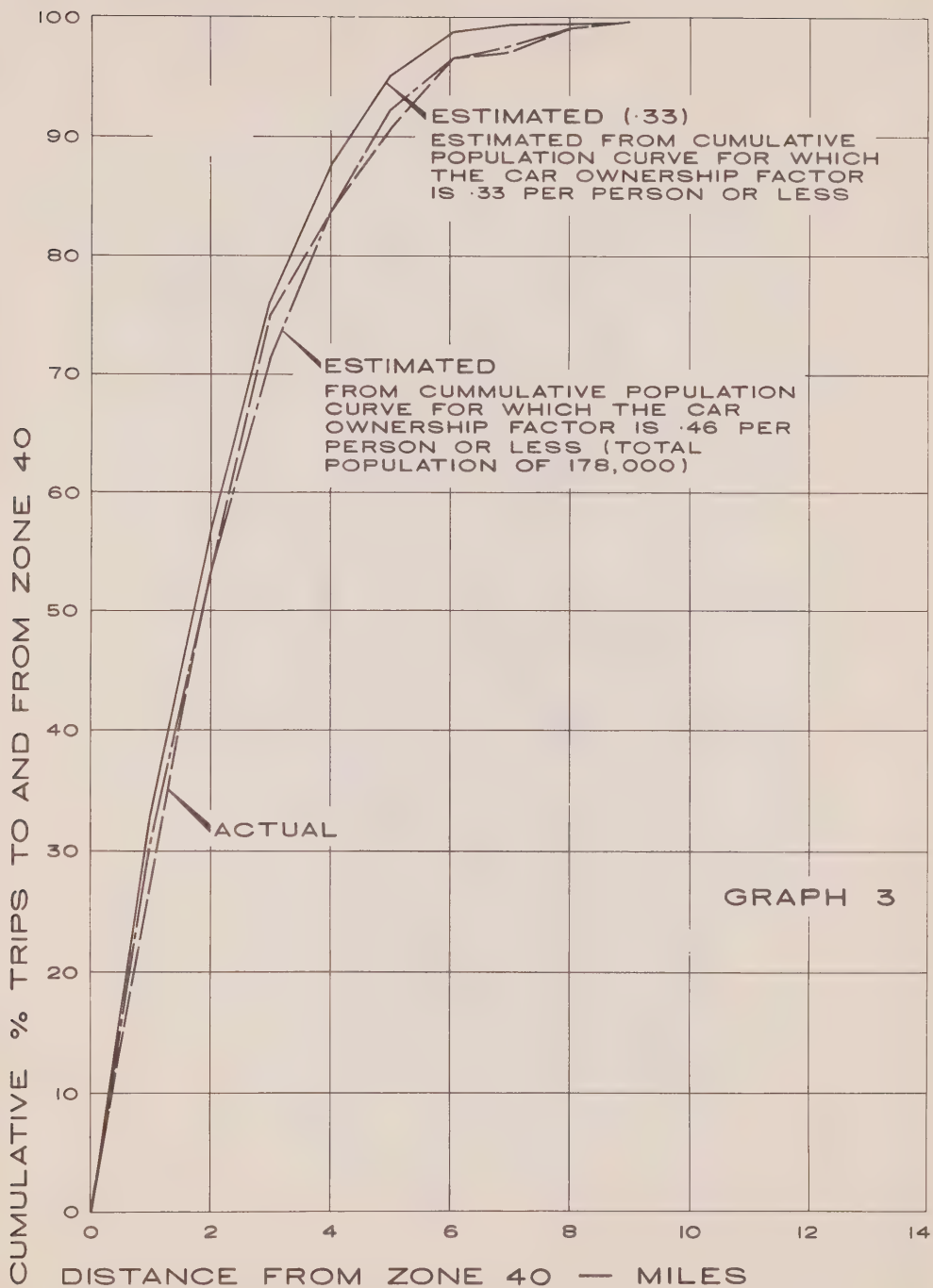
The effect of intensity has been assumed in direct proportion to the activity - the number of employment opportunities in the case of our example. Investigations could also be made for other intensity functions, in a manner similar to that which has been done for the time functions.

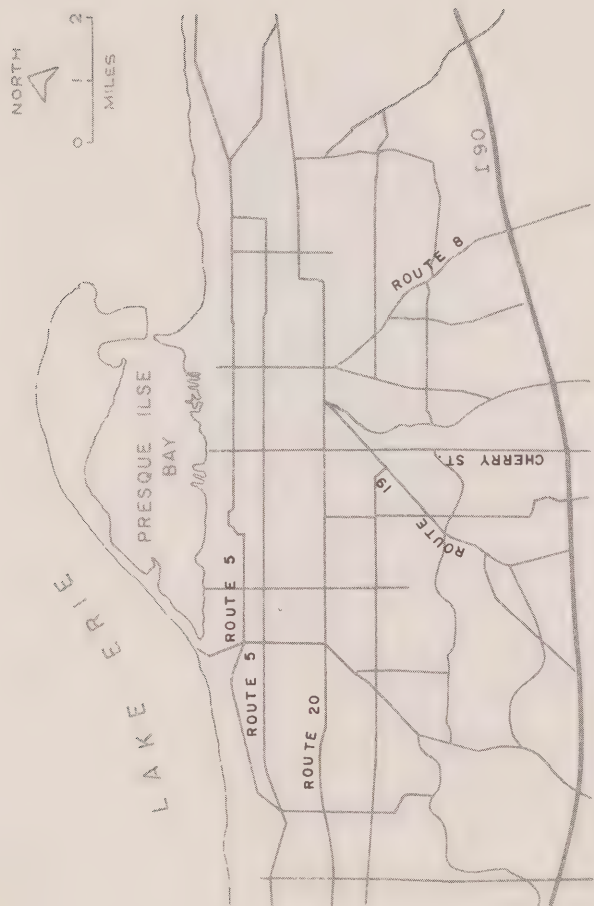
Source: 177. Erie Area Transportation Study, Volume II, Analysis and Forecasts, prepared for the Commonwealth of Pennsylvania in cooperation with the U.S. Department of Commerce, Bureau of Public Roads and the U.S. Housing and Home Finance Agency, October 1964.



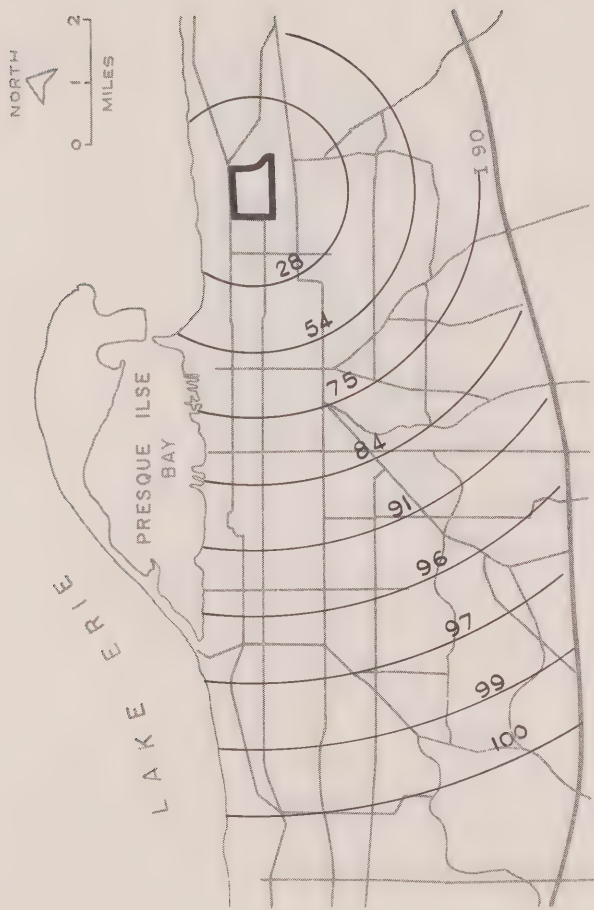


GRAPH 2

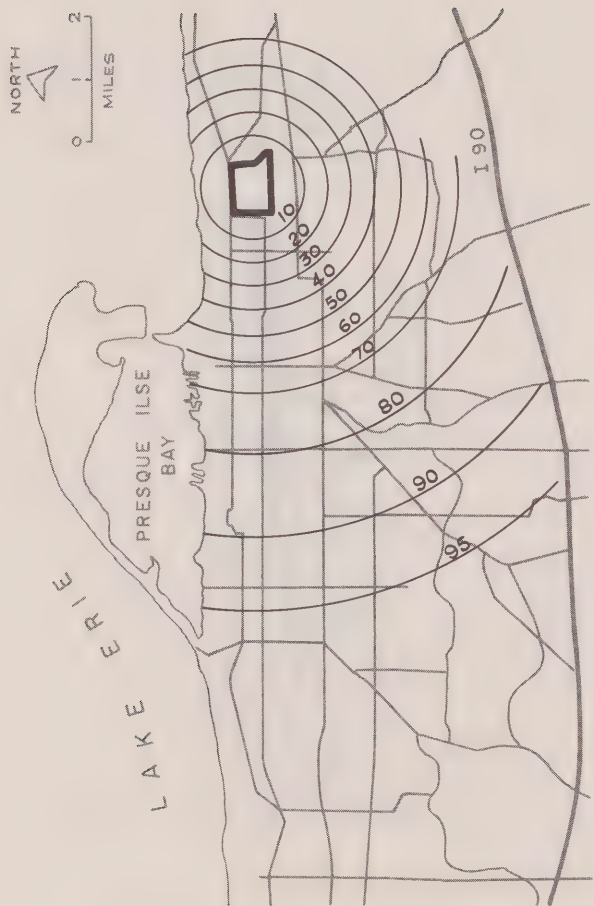




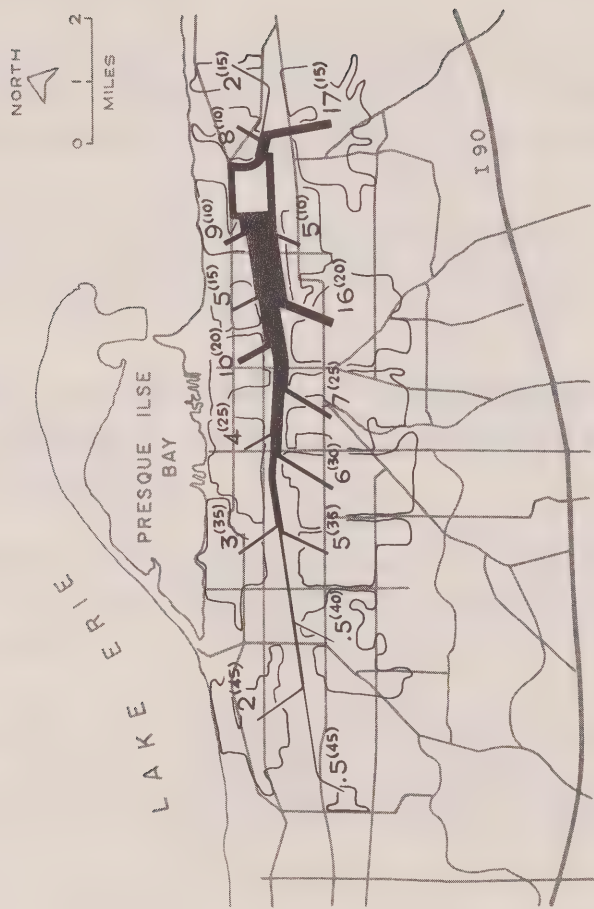
BASE PLAN



PERCENT OF TOTAL WORK TRIPS TO ZONE 40
IN 1 MILE INCREMENTS



PERCENT OF TOTAL WORK TRIPS TO ZONE 40
IN 10 PERCENT INCREMENTS



FLOW DIAGRAM OF WORK TRIPS
FOR INDUSTRIAL AREA - ZONE 40
PERCENT (TRAVEL TIME)

APPENDIX D-2
DISTRIBUTION OF TRIP ENDS
FOR SELECTED DISTRICTS TORONTO, ONTARIO

Data was collected in order to study different travel patterns in Metropolitan Toronto.

This was done by plotting on overlays, data from the Metropolitan Toronto and Region Transportation Study and by obtaining travel time from a map similar to that shown on page 7 of Appendix D-4.

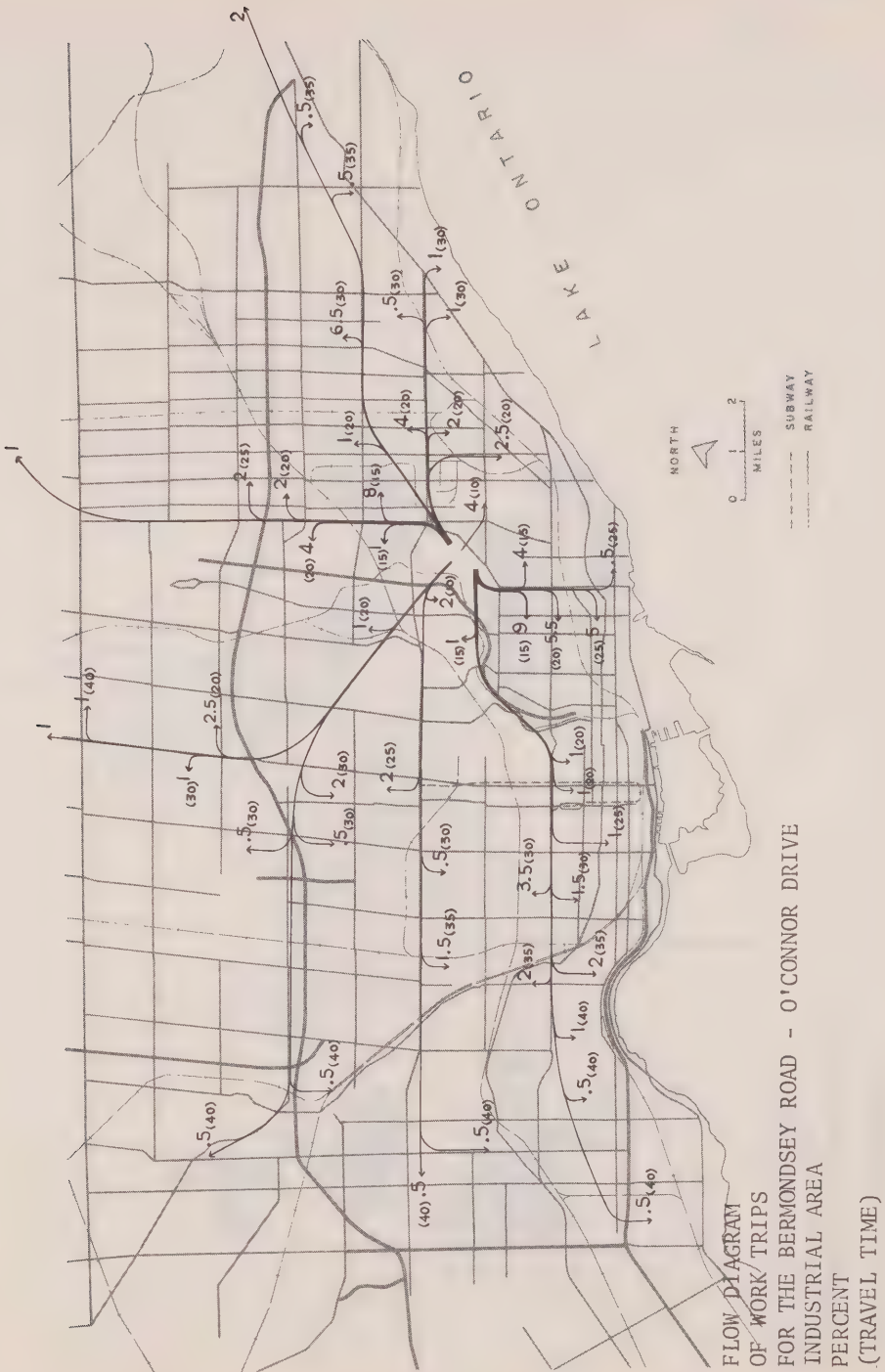
The study time allotted to this part of the project had to be curtailed however the following exhibits indicate the travel patterns that were to be studied.

Pages 2 and 3 show the residential trip end distribution for work trips destined for the medium industry area at Bermondsey Road and O'Connor Drive.

It was intended to extend this analysis to the considerations of compatibility between the residential communities and the employment area.

Similar analyses were started but not completed for social, shopping, recreational and business travel patterns. Pages 4 to 12 illustrate the patterns for which data is available.



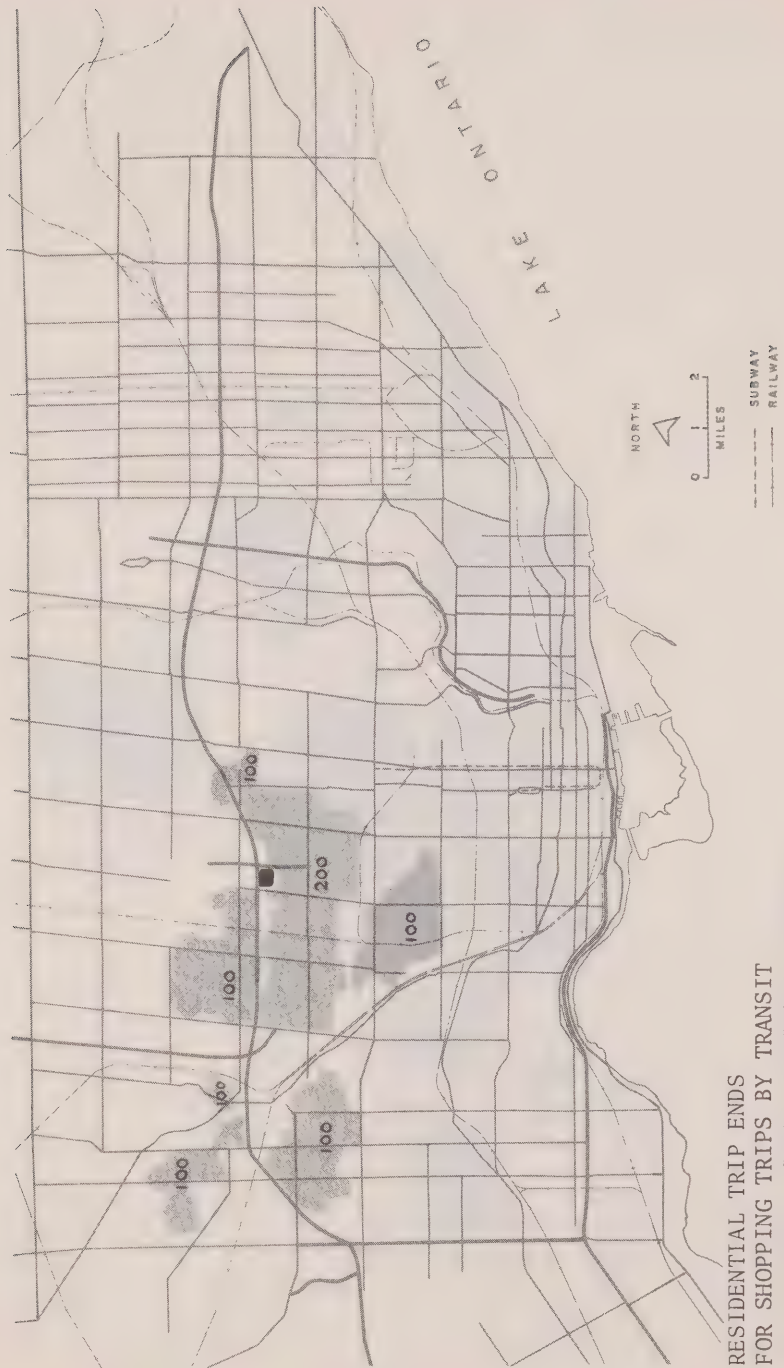




RESIDENTIAL TRIP ENDS
FOR SHOPPING TRIPS
TO TWO LOCAL SHOPPING AREAS
Analysis Not Completed

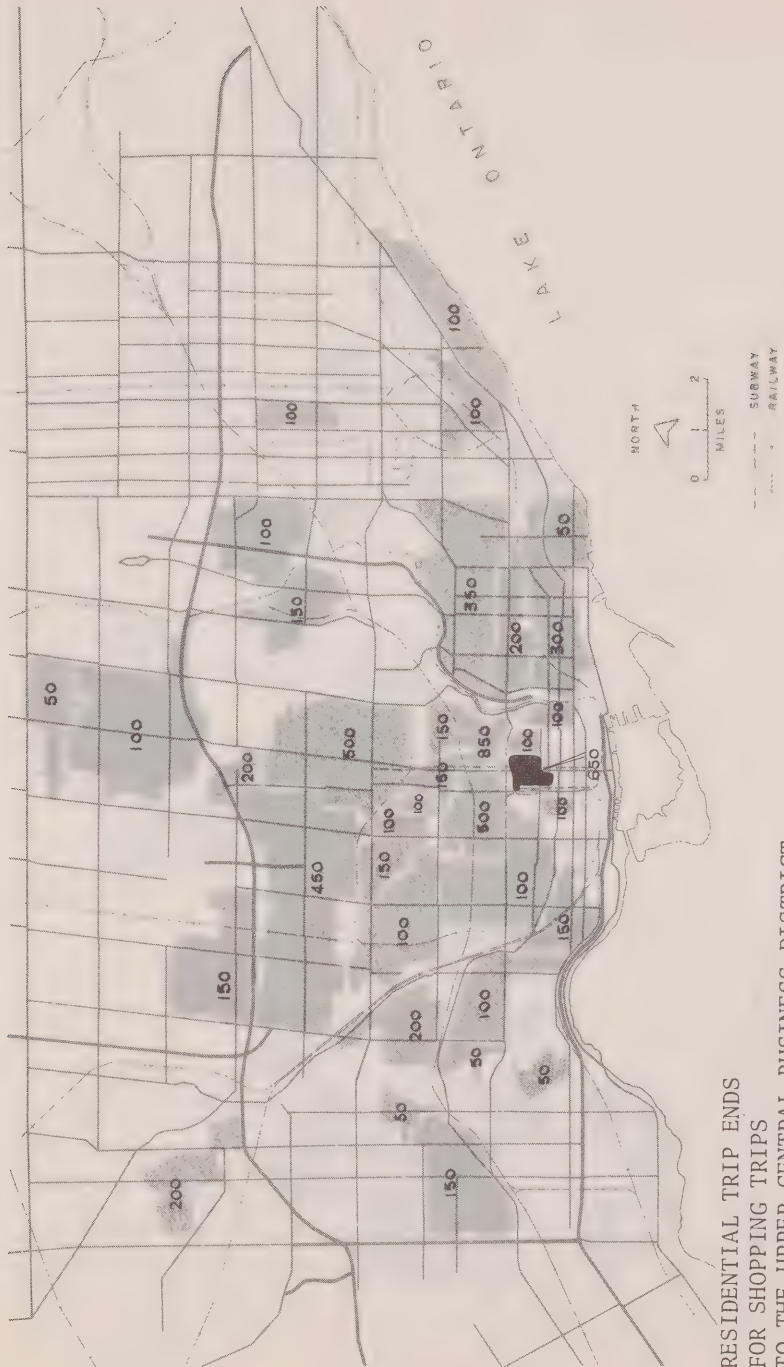


RESIDENTIAL TRIP ENDS
FOR SHOPPING TRIPS BY AUTO
TO A REGIONAL SHOPPING CENTRE (YORKDALE)
Analysis Not Completed



RESIDENTIAL TRIP ENDS
FOR SHOPPING TRIPS BY TRANSIT
TO A REGIONAL SHOPPING CENTRE

Analysis Not Completed



RESIDENTIAL TRIP ENDS
FOR SHOPPING TRIPS
TO THE UPPER CENTRAL BUSINESS DISTRICT

Analysis Not Completed

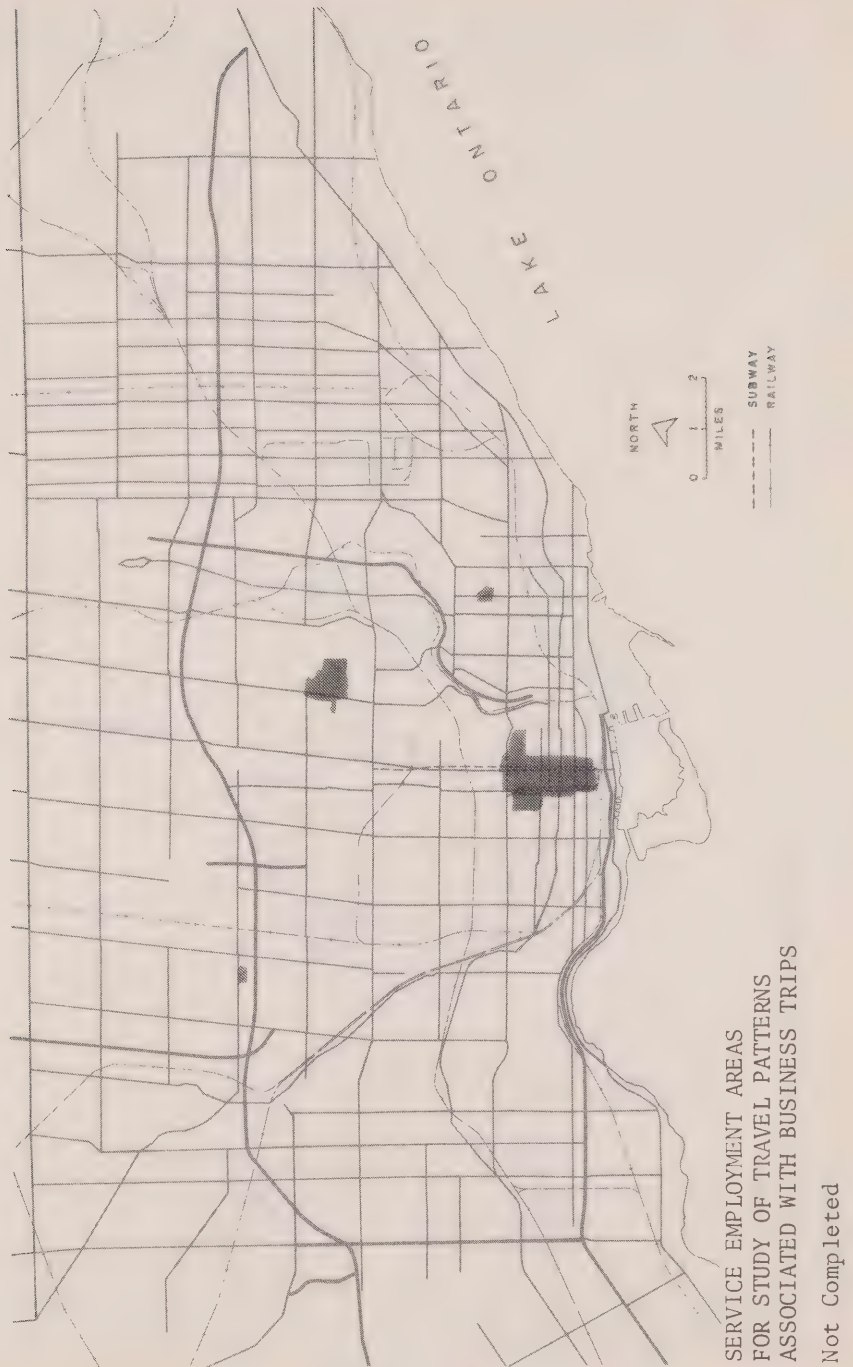


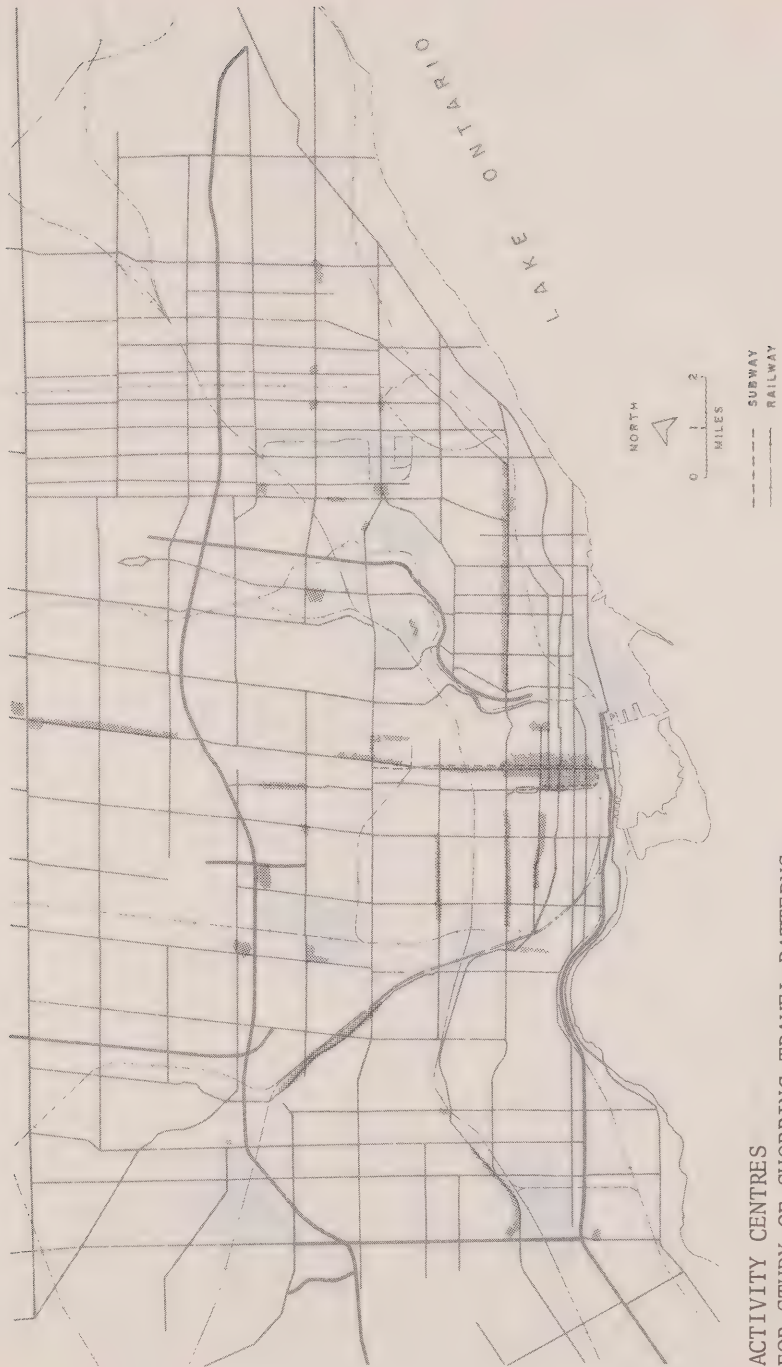
RESIDENTIAL TRIP ENDS
FOR SHOPPING TRIPS BY TRANSIT
TO THE LOWER CENTRAL BUSINESS DISTRICT

Analysis Not Completed



NEIGHBOURHOODS
FOR STUDY OF SOCIAL TRAVEL PATTERNS
Not Completed







INDUSTRIAL EMPLOYMENT AREAS
FOR STUDY OF WORK TRIP TRAVEL PATTERNS

Not Completed

APPENDIX D-3

NOTES ON A METHOD OF DISTRIBUTING WORK TRIPS BY RELATING PLACES OF RESIDENCE AND EMPLOYMENT

A study was carried out in Vancouver, B.C., with a view to determining the validity of the assumption that residential location is dependent on the cost of the journey to work.

In the paper that outlines the study, a trip distribution procedure was suggested for trips between work and residential areas. The following is an excerpt from this paper:

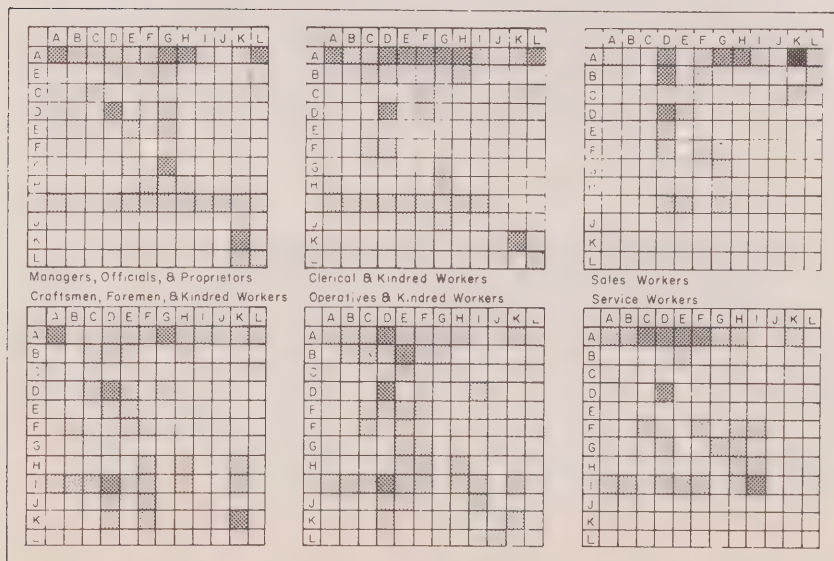
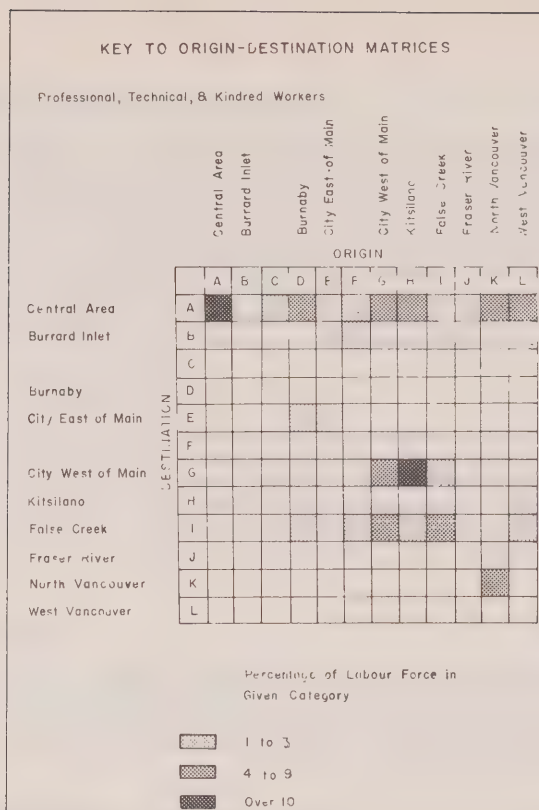
occupation with those in another with greater ease. Since the concern here is for gross movements of commuters from one major part of the city to another in each occupational category, the variation in size of the zones does not matter. The zones were selected on the basis of their overall homogeneity as follows:

- A) The Central Area, grouped for convenience with the West End.
- B) The generally working class residential area along the south shore of Burrard Inlet.
- C) Burnaby.
- E) The eastern part of the City of Vancouver.
- F) The "transitional" section straddling Main Street.
- G) The Point Grey Peninsula in the western part of the City of Vancouver.
- H) Kitsilano.
- I) The False Creek industrial area, but including also the hospital complex on 12th Avenue.
- J) The North Arm of the Fraser industrial area.
- K) North Vancouver.
- L) West Vancouver.

The boundaries of these areas are shown in Appendix A.

1. Professional, Technical, and Kindred Workers

Both employment and residences of professional and technical workers tend to be concentrated. The Central Area would seem to be the principal node towards which workers in this category are drawn--especially from the West End, the Point Grey Peninsula, and the North Shore. Apart from these major movement of conflux, workers in this category tend to find employment in the zone in which they reside. This is especially true of the Point Grey Peninsula considered as a whole, and in North Vancouver.



2. Managers, Officials, and Proprietors

For managers, officials, and proprietors, the patterns of commuting are somewhat different. Although there is conflux at the Central Area, it is from a city wide distribution, the Point Grey peninsula only providing a slightly higher proportion of workers in this category than other parts of the city. However, as indicated by the census also (see Fig. 2) the Point Grey peninsula is a favoured area of residence for workers in this category--they are however dispersed fairly widely for the purposes of employment. False Creek draws fairly widely in this category of employment--except from the areas to the north and east along the south shore of Burrard Inlet.

3. Clerical and Kindred Workers

A somewhat similar pattern is found for clerical workers, both the Central Area and False Creek forming major areas of conflux. Although the Point Grey peninsula is still an important zone of dispersion for this category, commuting is more local--to the Central Area, the Burrard Inlet industrial zone, and the North Arm of the Fraser. Burnaby, North Vancouver, and West Vancouver find their workers in this category from the local area.

4. Sales Workers

As would be expected, sales workers are drawn to the Central Area, especially from the Point Grey peninsula, North Vancouver, and Burnaby. The latter is a favoured residential area for this category, and workers commute from here not only to the Central Area, but to the City east of Main Street.

5. Industrial Workers

Craftsmen and foremen are distinguished from other operatives in order to show similarities rather than differences in their commuting patterns. For both, the major zones of conflux are in the Central Area, the Burrard Inlet industrial area, False Creek, and to a lesser extent the North Arm of the Fraser industrial area. For industrial workers residing in the city, there seems to be a tendency to work within the broadly-defined zone of residence, although this is not strongly marked. Largely, the most favoured residential areas are east of Main Street (cp. Fig. 2) and in Burnaby.

6. Service Workers

The final category to be considered, that of service workers, shows strongly marked conflux upon the Central Area, especially from east of Main Street, and also of False Creek. It must be remembered that this latter zone includes also the hospital complex on 12th Avenue, and that ward attendants, etc. will be drawn here from a fairly wide area.

The following conclusions may be drawn from this discussion.

- 1) In Vancouver, the residential segregation of the major occupational categories is marked--in general, manual workers residing east of Main Street, and white-collar workers on the Point Grey peninsula and the North Shore. Within this category, clerical workers are highly concentrated towards the central area.
- 2) The length of the journey to work is more a function of the relative concentration of employment opportunities and of the residences of workers than of any economic determinant. On the average, workers in all occupational categories in Vancouver travel about 4 miles to work.
- 3) Commuting to the central area is strongly marked in all categories of employment and from all parts of the city. Even so, currents cut across and run counter to the dominant centrifugal and centripetal movements, depending upon occupational categories.

¹The West End in the area between the downtown and Stanley Park.

²Ann McAfee, Residences on the Margins of the Urban Core: A Case Study of the West End, Vancouver, B. C. (Unpublished M.A. thesis, Department of Geography, University of B. C., 1965).

³The source of data used in this chapter has been the Vancouver City Directory for 1963 from which a systematic sample of 1775 persons was taken, representing 0.78 percent of the residential labour force of Vancouver Burnaby, North and West Vancouver, the area covered by the directory. The occupation, sex, marital status, employer, zone of residence and zone of employment were recorded for each person in the sample. For a partial sample of 825 persons, the air-line distance between work and residence was measured and information pertaining to the employer interpolated from Dun and Bradstreet and Contacts Influential. See Appendix A.

⁴W. G. Hansen, "How Accessibility Shapes Land Use", Special Issue of the Journal of the American Institute of Planners (May, 1959), pp. 73-76.

⁵T. R. Lakshmanan, "An Approach to the Analysis of Intraurban Location Applied to the Baltimore Region", Economic Geography, 40 (October, 1964), pp. 348-370.

⁶Walter Isard, Methods of Regional Analysis (Cambridge, Mass.: M.I.T., 1960), pp. 493-566.

⁷See Appendix B.

⁸Kate Liepman, The Journey to Work (London: Routledge and Kegan Paul, 1944).

⁹Beverly Duncan, op. cit.

¹⁰Ibid.

¹¹L. G. Reeder, "Social Differentials in Modes of Travel, Time and Costs in the Journey to Work", American Sociological Review, 21 (February, 1956), pp. 56-63.

¹²Beverly Duncan, op. cit.

¹³William Goldner, "Spatial and Locational Aspects of Metropolitan Labour Markets", American Economic Review, 45 (1955), pp. 113-128.

Source: 132. Wolforth, John R. "Residential Location and The Place of Work", in B.C. Geographical Series, Number 4, W.G. Hardwick, Ph.D., editor, Tantalus Research Limited, Vancouver, Canada 1965.

APPENDIX D-4

EXAMPLE: ORGANIZATION OF THE METROPOLITAN TORONTO DATA FOR TRIP DISTRIBUTION

The following drawings indicate how the City of Metropolitan Toronto could be organized for the trip distribution procedure outlined in the report.

The drawings are:

1. Residential Areas For Travel Analysis Page 3

Adjacent communities having similar travel characteristics are combined for simplicity in the travel analysis. These are numbered as a 300 series.

2. Employment Areas For Travel Analysis Page 4

Similar employment areas adjacent to one another are combined. These are numbered as a 400 series.

3. Activity Centres For Analysis of Weekday Travel Page 5

Parks and similar areas that would not contribute significantly to weekday travel and not considered in the travel analysis. This drawing shows only the major generators of travel.

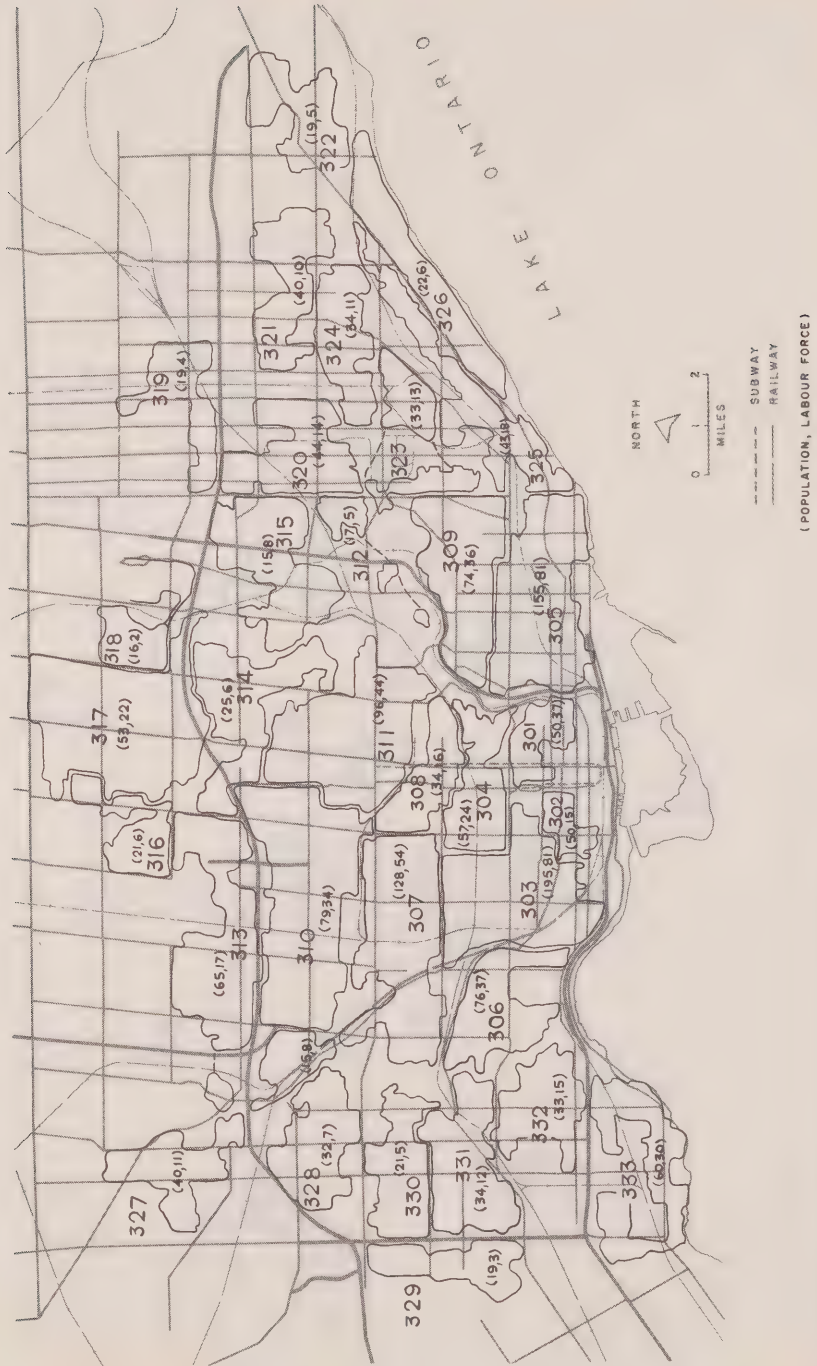
4. Activity Centres Requiring Special Travel Analysis Page 6

Travel to and from centres such as Maple Leaf Gardens, the Canadian National Exhibition, and the Toronto International Airport could be analyzed separately for special travel patterns. This drawing shows these centres and others in the Toronto area for which special analysis could be made. These are numbered as a 600 series.

5. Travel Time in Five Minute Increments

Page 7

Travel time is calculated in five minute intervals for each roadway and recorded on an overlay of the base plan. Travel time between areas is obtained by adding the five minute increments along a particular route.



RESIDENTIAL AREAS FOR TRAVEL ANALYSIS



ACTIVITY CENTRES FOR ANALYSIS OF WEEKDAY TRAVEL

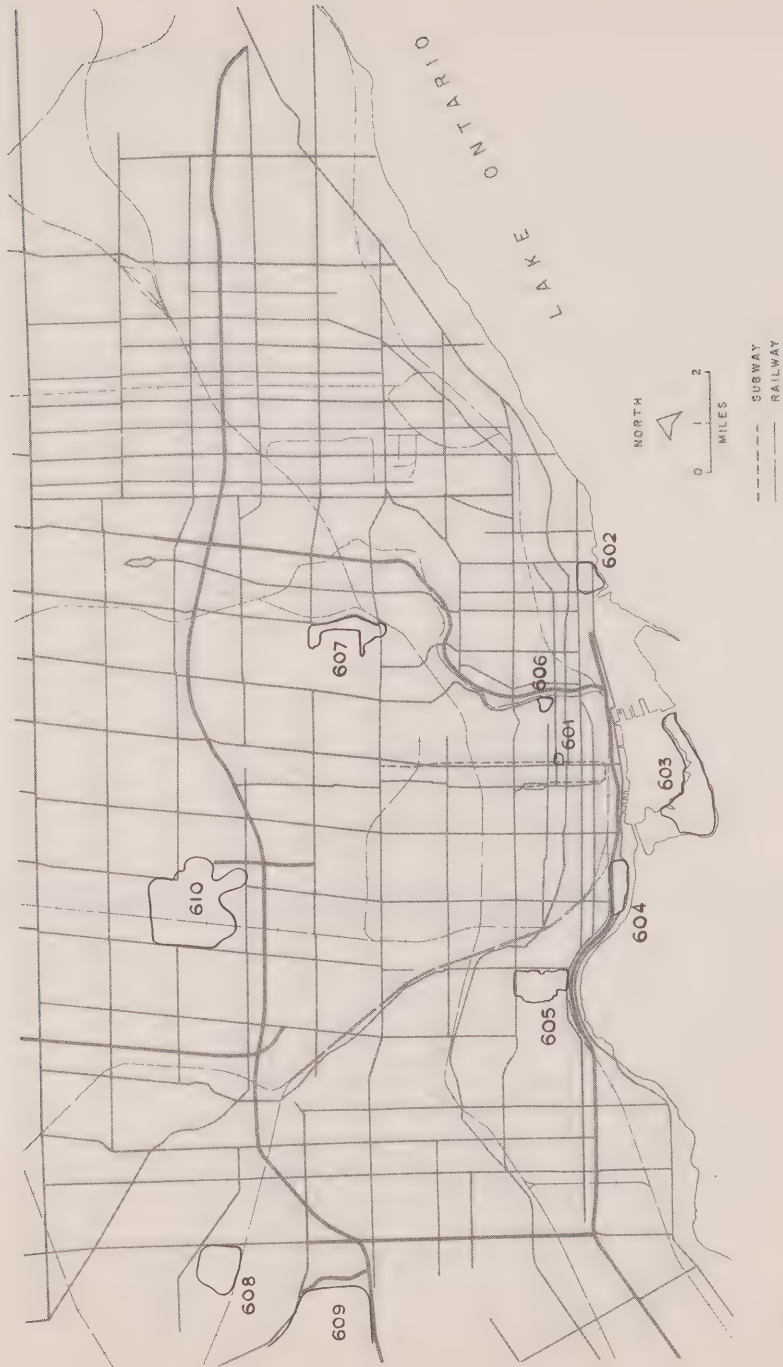
501.	Central Business District	515.	Yonge - Eglinton
502.	Queen Street East Shopping Area	516.	York University - Glendon Campus
503.	Queen Street West Shopping Area	517.	Don Mills Shopping Centre
504.	College Street and Kensington or "Jewish" Market	518.	Golden Mile and Eglinton Square Shopping Centre
505.	Bloor Street West Shopping Area	519.	Centennial College of Applied Arts and Technology
506.	Yorkville	520.	Dundas Street - Cloverdale Shopping Area
507.	University of Toronto	521.	Toronto International Airport
508.	Government of Ontario Buildings	522.	York University - Keele Street Campus
509.	Yonge Street	523.	Downsview Airport
510.	The Danforth Shopping Area	524.	Yorkdale Shopping Centre
511.	Dundas Street Shopping Area	525.	Avenue Road - Yonge Street
512.	Weston Road	526.	North Yonge Street
513.	Eglinton Avenue West		
514.	St. Clair Avenue West		



ACTIVITY CENTRES FOR ANALYSIS OF WEEKDAY TRAVEL

ACTIVITY CENTRES REQUIRING SPECIAL TRAVEL ANALYSIS

601.	Maple Leaf Gardens	606.	Riverdale Zoo
602.	Greenwood Racetrack	607.	Edwards Gardens, Wilket Creek and Serena Gundy Parks
603.	Toronto Island Park	608.	Toronto International Airport
604.	Canadian National Exhibition	609.	Woodbine Racetrack
605.	High Park	610.	Downsview Airport



ACTIVITY CENTRES REQUIRING SPECIAL TRAVEL ANALYSIS



TRAVEL TIME IN FIVE MINUTE INCREMENTS

APPENDIX E

APPENDIX E-1
 DATA ON TRIP LENGTHS BY PURPOSE
 FOR ST. LOUIS, KANSAS CITY AND CHARLOTTE

The data for St. Louis from the following table was plotted on six graphs. These are shown on pages 2 to 7.

TABLE 3
 COMPARISON OF TRIP LENGTHS BY PURPOSE-SELECTED STUDIES

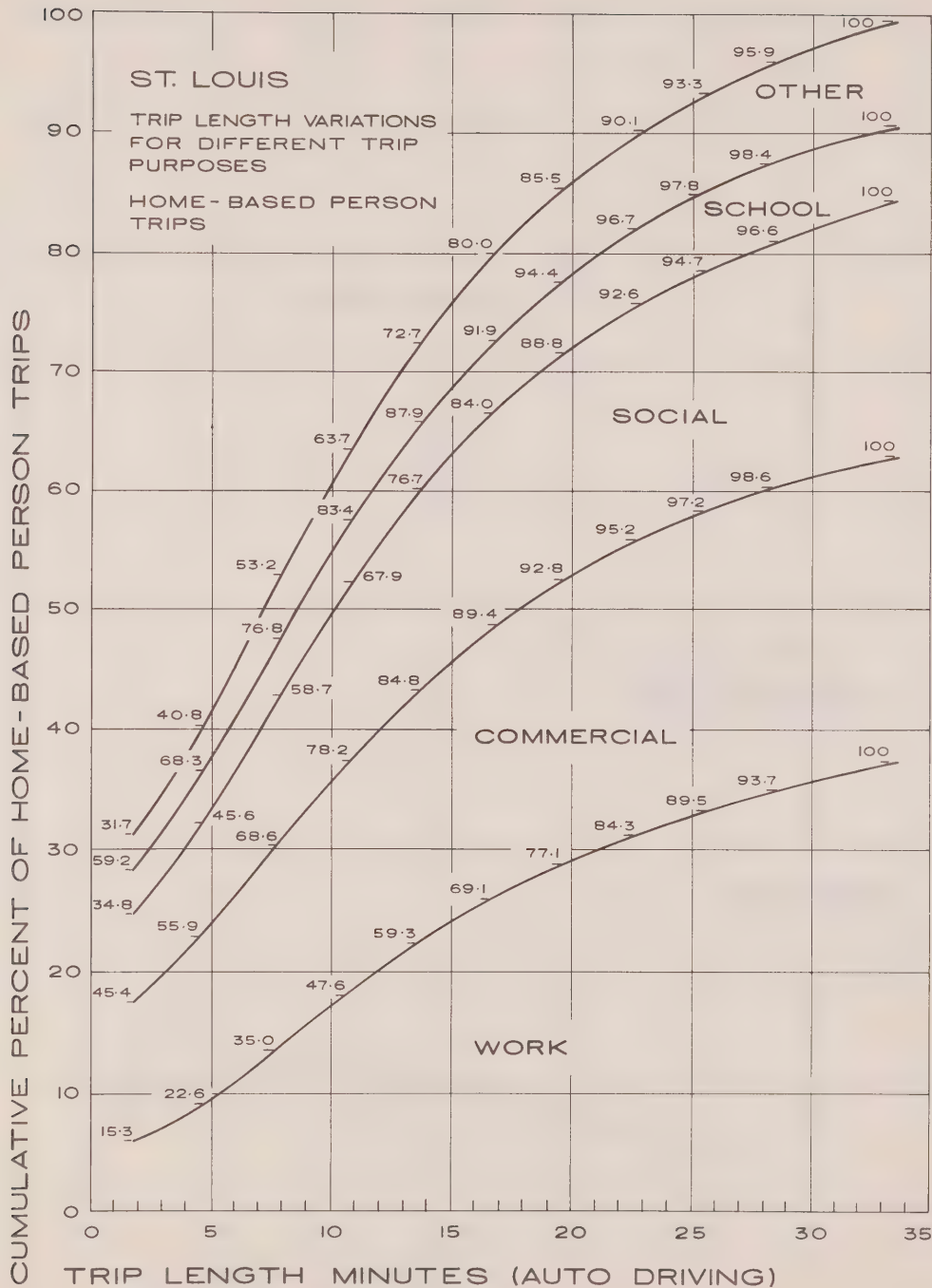
Trip Length (min)	Cumulative Percent of Trips by Residents, Internal Survey														
	Work Trips			Commercial Trips			Social Trips			School Trips			Total Trips		
	St. Louis ²	Kansas City ²	Char-lotte ²	St. Louis	Kansas City	Char-lotte	St. Louis	Kansas City	Char-lotte	St. Louis	Kansas City	Char-lotte	St. Louis	Kansas City	Char-lotte
0	3.6	2.2	5.8	15.2	10.8	18.0	11.5	14.3	15.1	21.7	30.5	23.4	10.1	9.8	12.9
0 - 3	15.3	13.9	11.5	45.4	35.1	27.4	34.8	39.4	22.5	59.2	51.7	35.8	31.7	29.9	21.5
3 - 6	22.6	17.2	25.8	55.9	43.7	48.1	45.6	46.8	40.6	68.3	52.5	57.9	40.8	38.8	40.0
6 - 9	35.0	26.4	46.5	68.6	56.7	68.0	58.7	55.8	60.3	76.8	65.2	78.2	53.2	47.9	60.2
9 - 12	47.6	40.6	66.4	78.2	68.0	82.0	67.9	65.0	75.2	83.4	70.6	87.3	63.7	59.5	76.4
12 - 15	59.3	54.9	80.5	84.8	77.3	90.3	76.7	75.8	85.2	87.9	75.5	93.1	72.7	70.4	86.6
15 - 18	69.1	66.8	90.0	89.4	84.3	96.2	84.0	82.4	92.5	91.9	78.5	96.5	80.0	78.8	93.5
18 - 21	77.1	76.5	95.7	92.8	90.1	98.8	88.8	87.5	96.7	94.4	85.7	99.3	85.5	85.4	97.3
21 - 24	84.3	83.2	98.5	95.2	94.0	99.5	92.6	91.8	98.6	96.7	88.0	99.9	90.1	89.9	99.0
24 - 27	89.5	88.7	99.5	97.2	95.8	100.0	94.7	94.3	99.6	97.8	97.6	100.0	93.3	93.4	99.7
27 - 30	93.7	93.4	99.9	98.6	97.9	100.0	96.6	96.3	99.9	98.4	99.9	100.0	95.9	96.1	100.0
Over 30	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Avg Length (min)	14.4	14.8	11.0	7.6	9.1	6.9	9.7	9.3	8.1	6.0	8.0	5.7	10.7	10.8	8.1

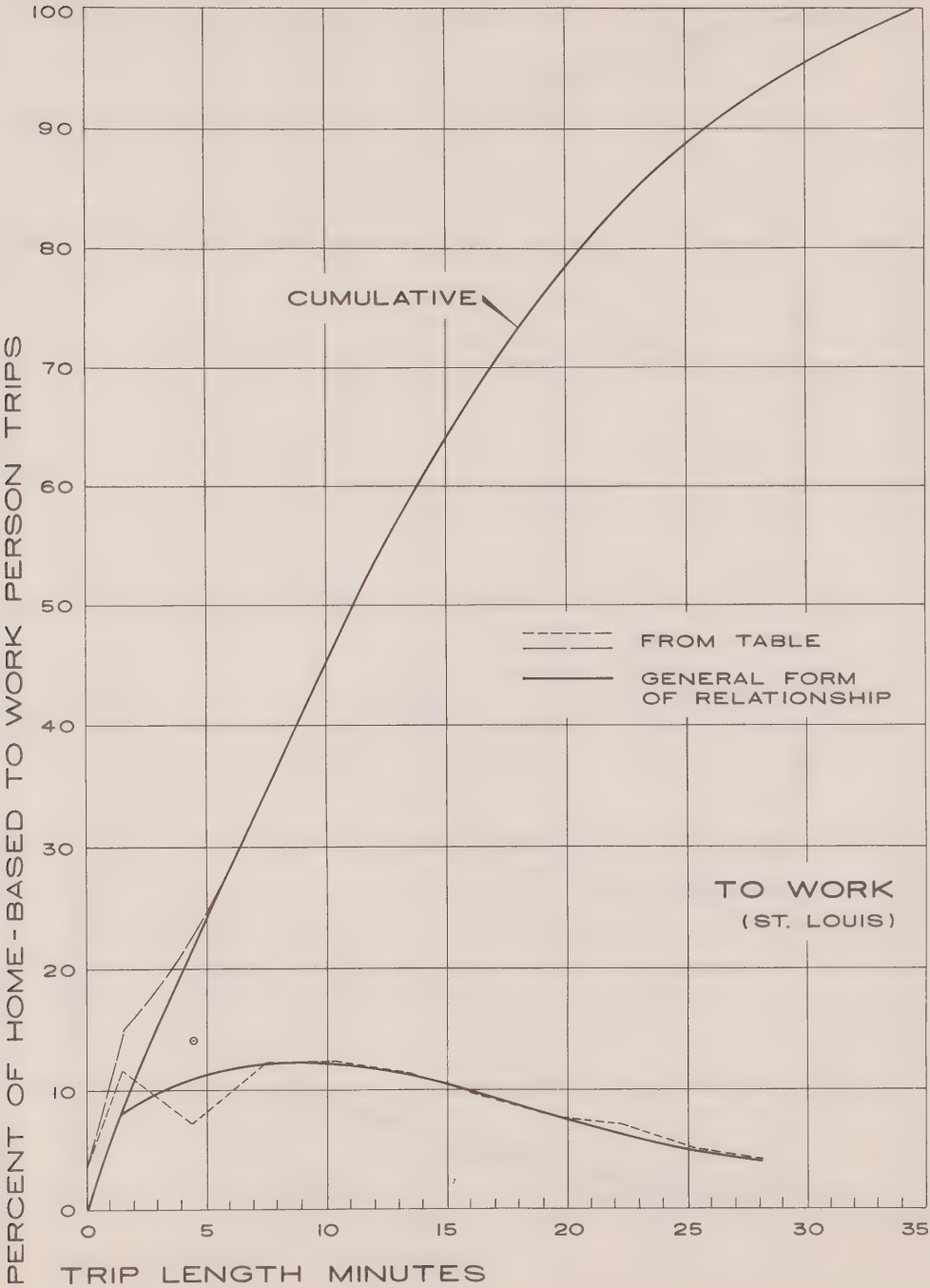
¹ Intra-zone trips.

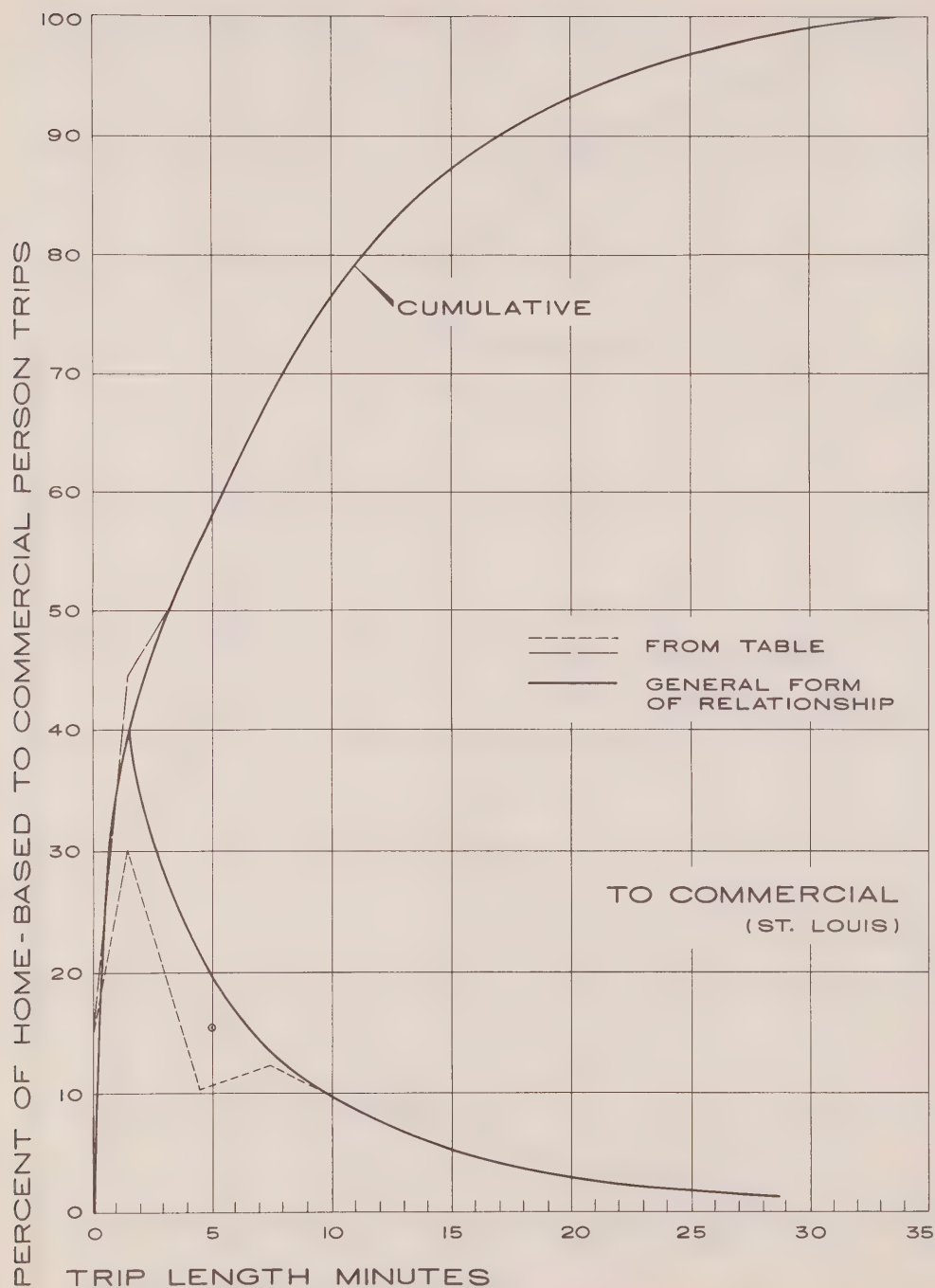
² St. Louis and Kansas City data are for all modes; Charlotte, auto drivers only.

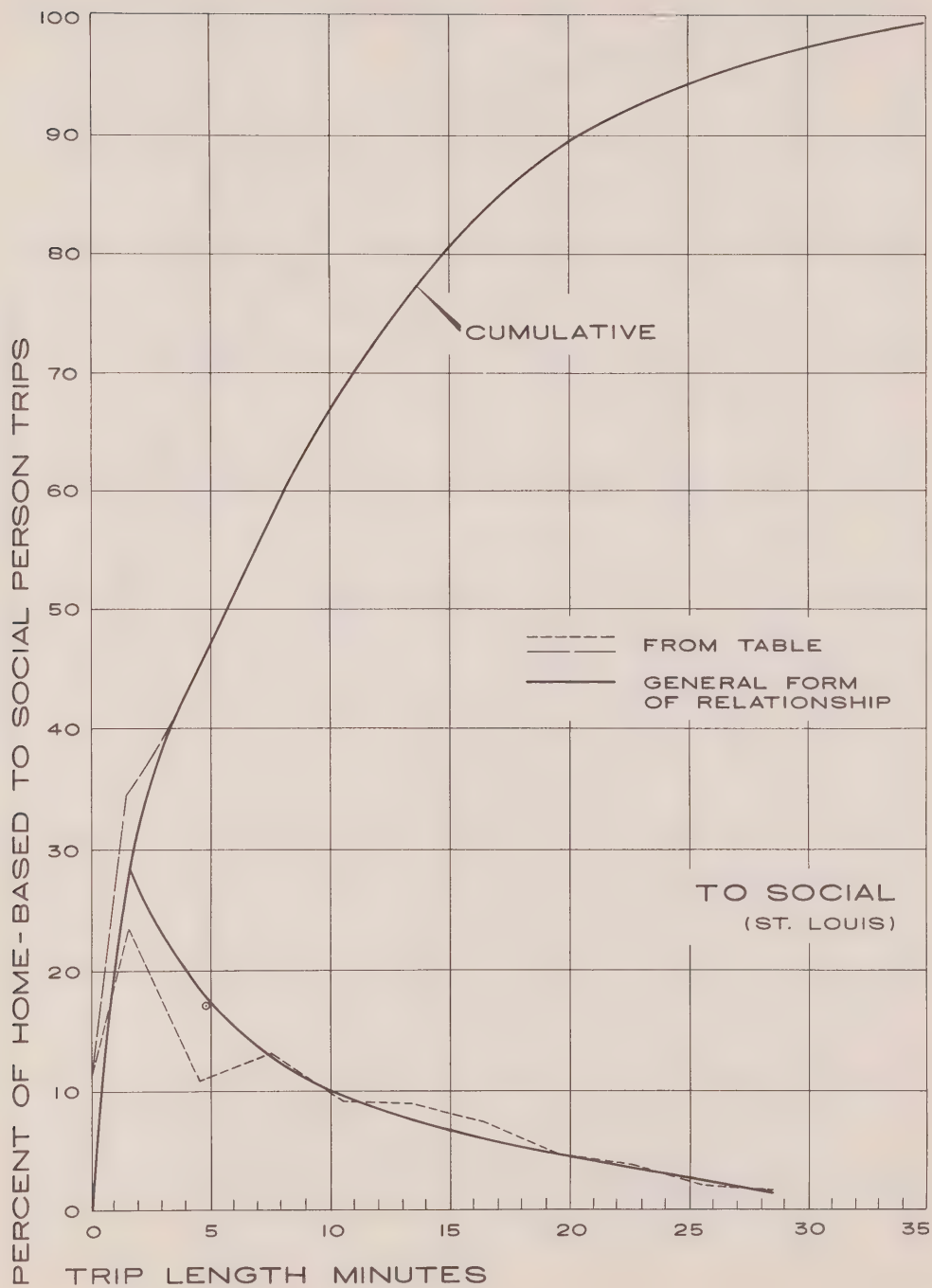
Source: 138. Wynn, F. Houston and C. Eric Linder.
 "Tests of Interactance Formulas
 Derived from O-D Data", Highway Research
 Board Bulletin 253, January 1960.

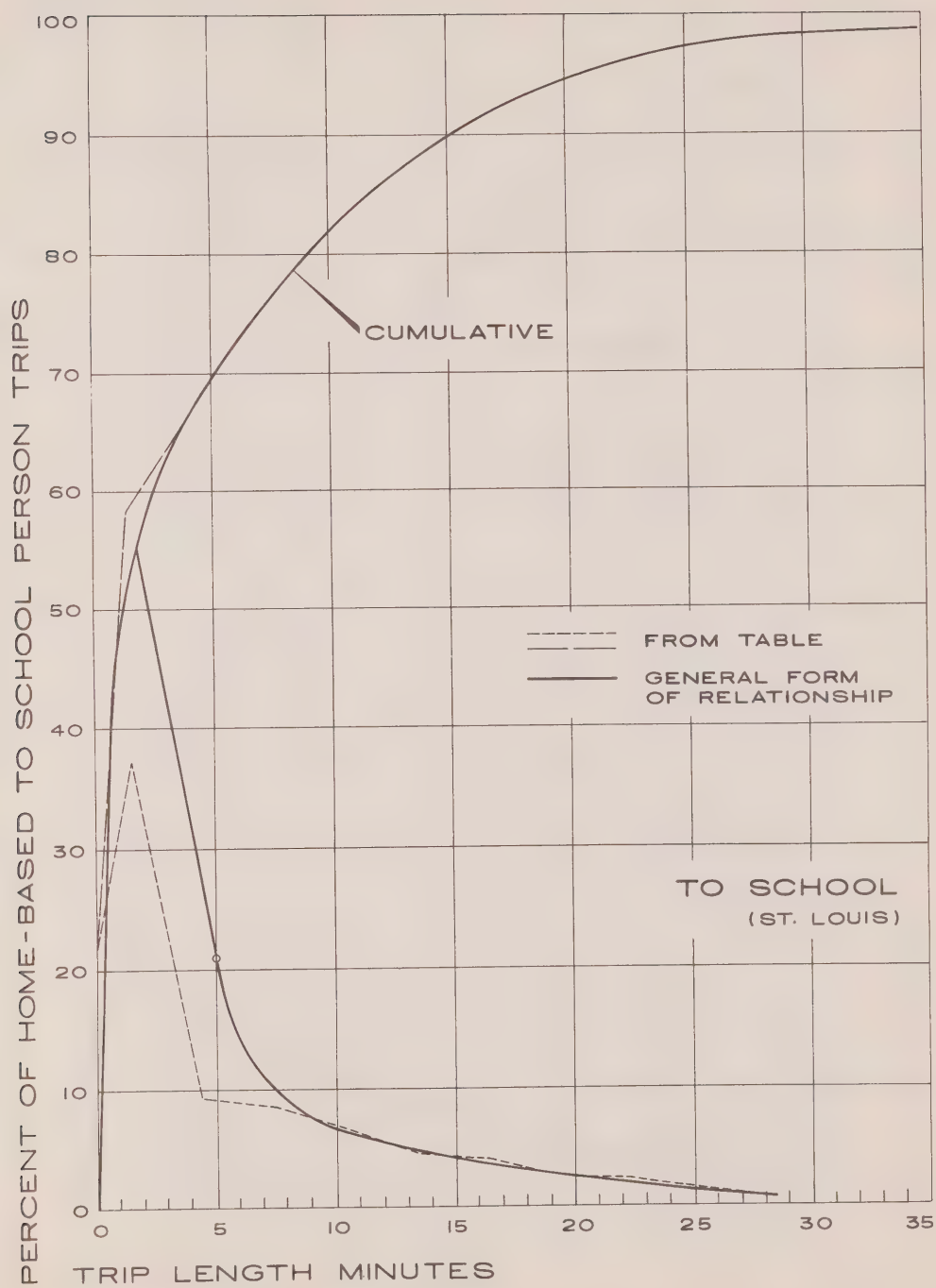
Source: 189. St. Louis Metropolitan Area Transportation
 Study 1957-1970-1980, prepared by W.C. Gilman
 & Company.

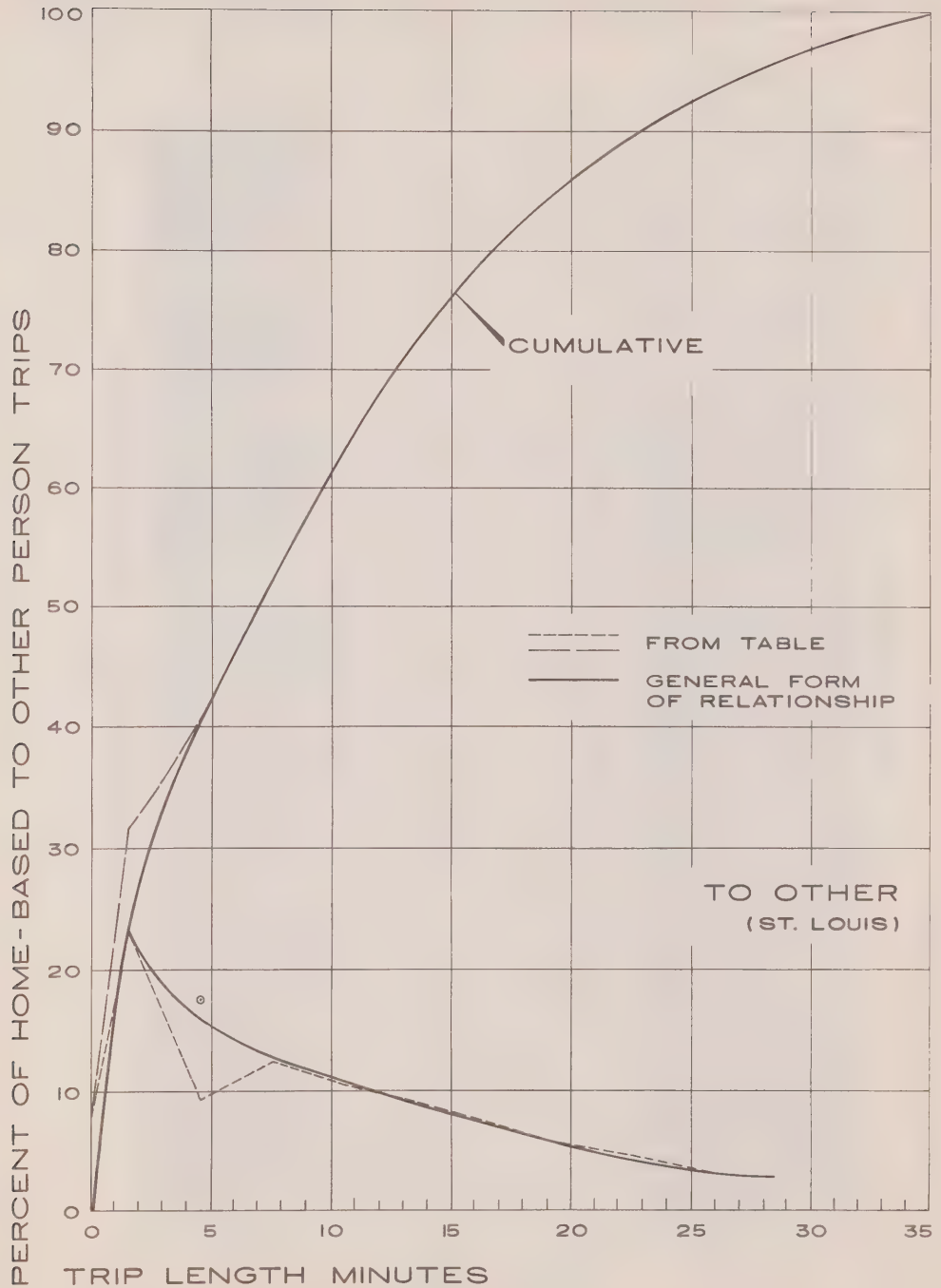












APPENDIX E-2
DATA ON TRIP LENGTH
FOR THE PITTSBURGH AREA

FIGURE 9
PER CENT OF INTERNAL PERSON TRIPS BY TRIP LENGTH AND TRIP PURPOSE

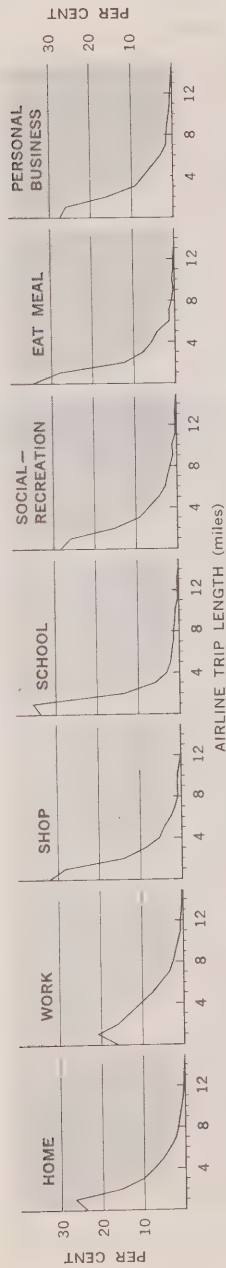


FIGURE 25
PER CENT OF INTERNAL VEHICLE TRIPS BY TRIP LENGTH AND VEHICLE TYPE

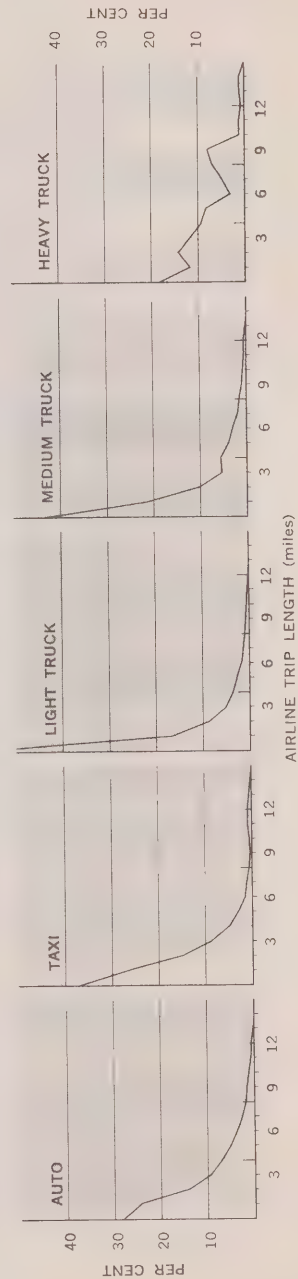


FIGURE 10
COMPARISON OF AVERAGE TRIP LENGTHS WITH NUMBER OF TRIPS
TO SELECTED LAND USES, INTERNAL PERSON TRIPS

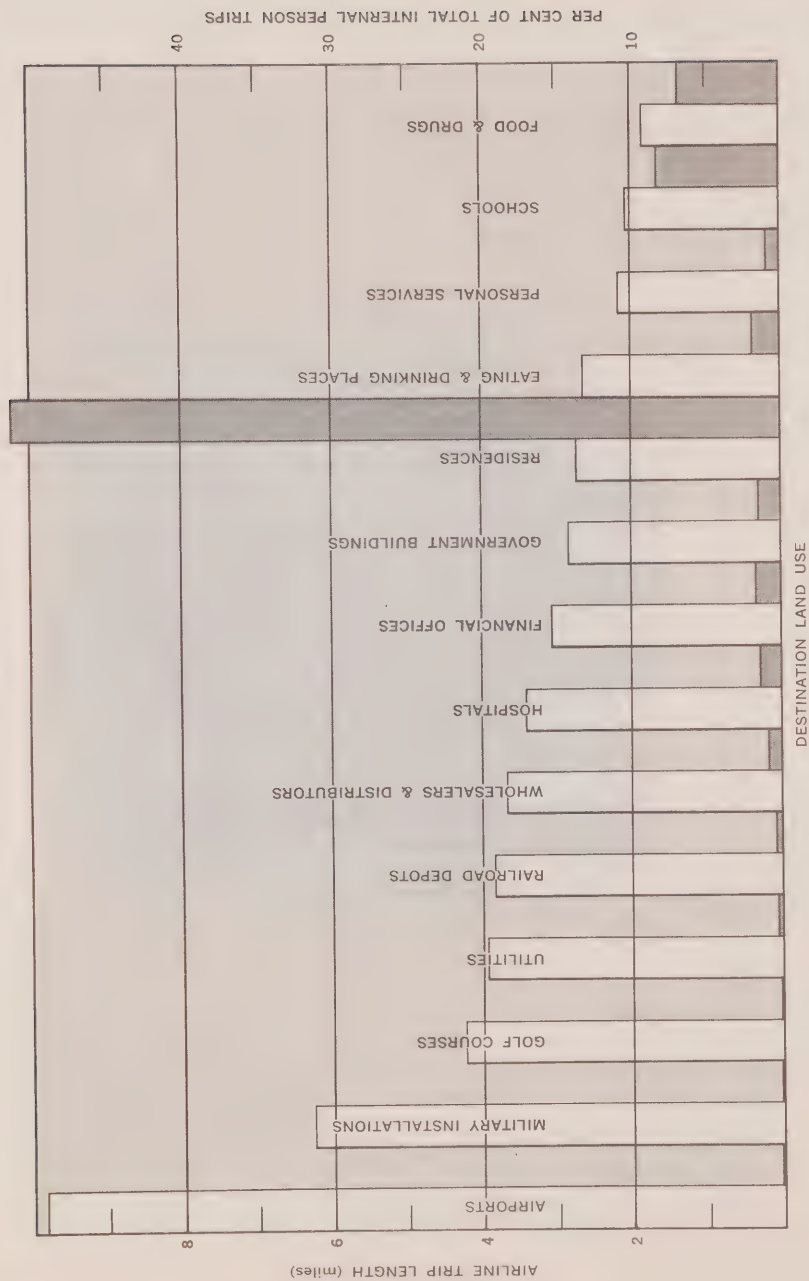


FIGURE 16
PER CENT OF INTERNAL PERSON TRIPS BY TRIP LENGTH
AND MODE OF TRAVEL

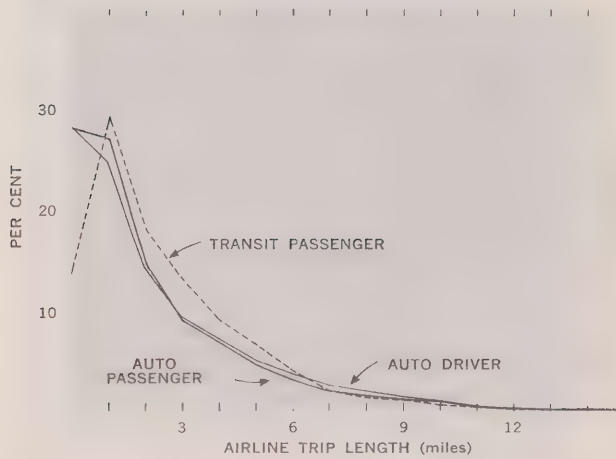


FIGURE 23
PER CENT OF INTERNAL AND EXTERNAL AUTO AND
TRUCK TRIPS (unweighted) BY TRIP LENGTH

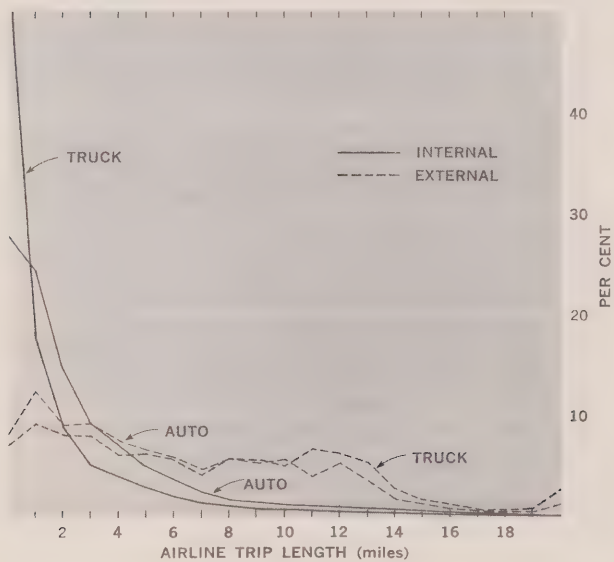
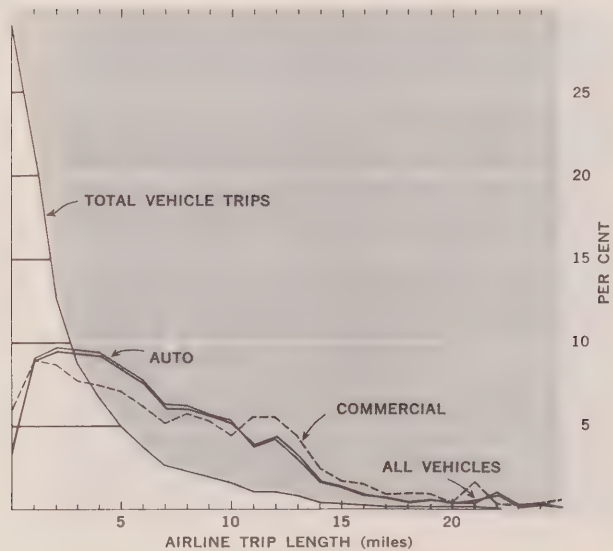


FIGURE 61
PER CENT OF TOTAL VEHICLE TRIPS AND VEHICLE-MILES OF
TRAVEL BY VEHICLE TYPE AND TRIP LENGTH



APPENDIX F

APPENDIX F-1

DATA ON GENERATION OF TRUCK TRIPS FROM WAREHOUSES

Discussions were held with people connected with warehousing. It was found that for a city such as Toronto the truck trip generation could be:

6 truck trips per day per warehouse employee.
Of these trips approximately 50% would be made by local cartage firms to the metropolitan area using small box vans and pick-up trucks. The remainder are made by large trucks that significantly affect traffic flow.

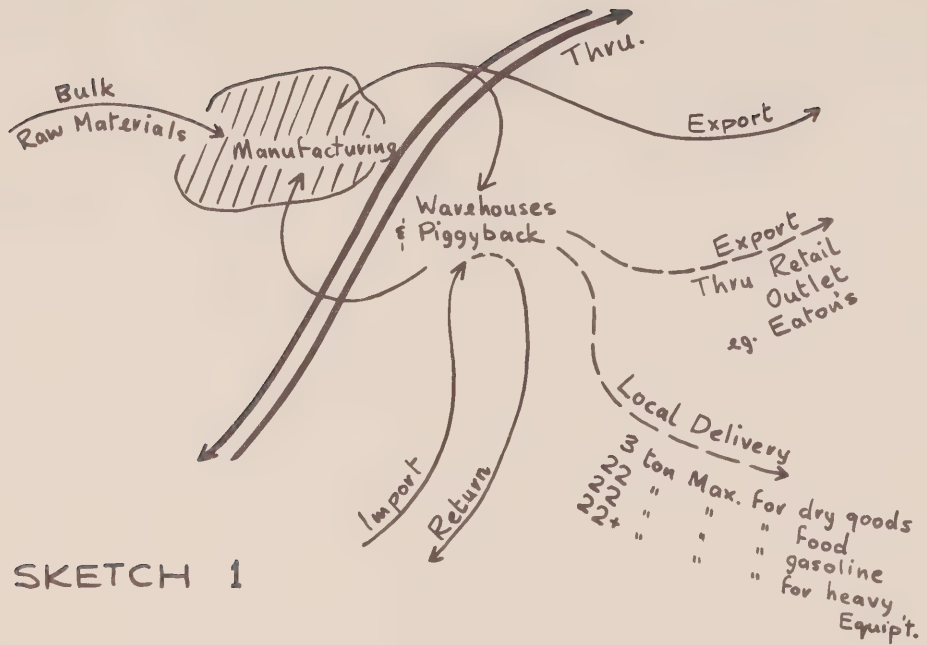
APPENDIX F-2
DATA ON A TRUCK TRIP TRAVEL PATTERN FOR
URBAN EXPORT-IMPORT TRUCKING OPERATIONS

There are several classifications for licensing trucking operations. Licenses do not follow planning, political or regional boundaries and this tends to complicate the analysis of truck travel patterns.

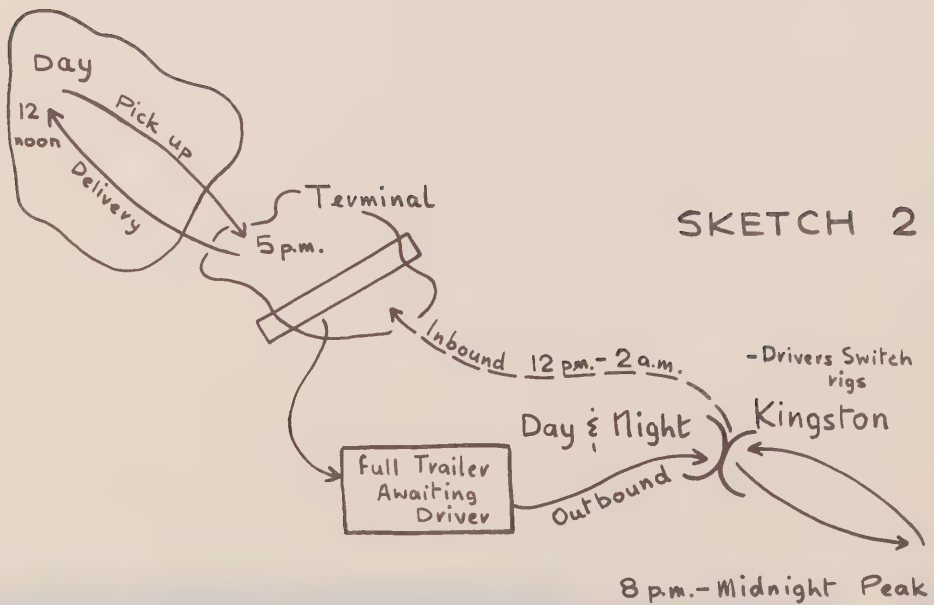
At present the trucking industry is just beginning to research costs, trip generation and travel patterns.

Two sketches on page 2 show general travel patterns for inter-city trucking.

Source: Discussions between E. Fearnley and
Mr. Douglas Toms of Smith Transport Ltd.



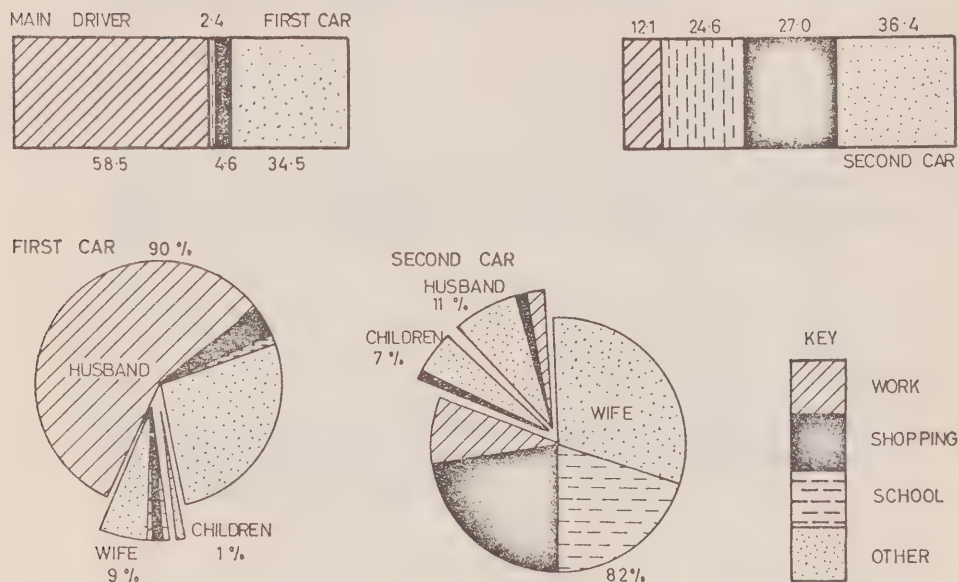
SKETCH 1



SKETCH 2

APPENDIX G-1
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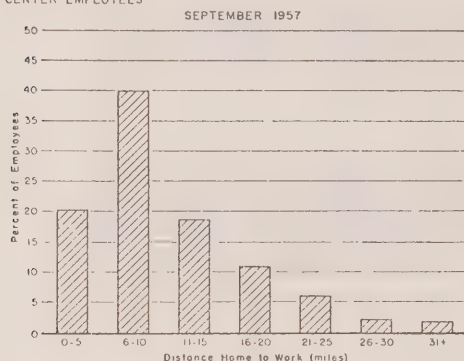


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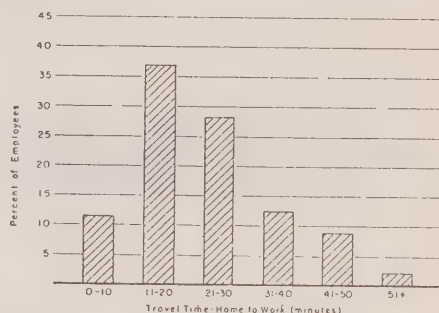
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DISTANCE HOME TO WORK FOR ALL NEW ENGLAND INDUSTRIAL CENTER EMPLOYEES



TRAVEL TIME TO WORK FOR ALL NEW ENGLAND INDUSTRIAL CENTER EMPLOYEES.



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TABLE 14
MINIMUM-COST SPACING RESULTS--1980

Ring	Spacing (mi)		
	Expressways	Arterials	Junior Expressways
	z	y	j
0	1.3	0.20	-
1	2.2	0.40	-
2	2.7	0.40	-
3	2.8	0.40	-
4	2.9	0.55	-
5	4.0	0.66	2.5
6	6.3	0.90	3.2
7	7.0	1.10	4.0

Although not stated clearly from other data it appears that Ring 0 has a radius of 0.5 miles, rings 1 to 4 are 2 miles apart, and rings 5 to 7 are 2 to 5 miles apart.

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Income	Trip Length	Trip Time (min)
\$0-1999	2.26	23.7
2000-2999	4.60	32.7
3000-3999	6.07	34.2
4000-4999	5.62	33.4
5000-5999	7.50	32.2
6000-7499	9.16	32.8
7500-9999	11.00	33.3
10,000-14,999	12.00	32.5
15,000-24,999	14.42	32.6
25,000 and over	10.57	27.2

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TABLE 1
SURVEY AREA CHARACTERISTICS

Characteristic	Lancaster 1963	York 1963	Reading 1964	Hutchinson 1959	Sheboygan 1963	Rock Hill 1964
Size (sq mi)	56	98.9	50	48.6	41.9	73.5
Population	103,931	122,075	178,273	40,864	56,923	43,042
Passenger cars owned	35,705	44,501	60,665	14,760	19,486	12,729
Number of dwelling units	36,381	42,233	63,200	13,078	18,219	12,789
Residential land use (%)	16.3	16.4	15.9	14.9	11.2	9.1
Industrial land use (%)	1.8	2.1	2.6	3.9	3.2	0.5
Transportation land use (%)	7.5	5.3	2.1	11.9	8.1	5.7
Retail land use (%)	0.8	7.8	0.9	1.3	0.6	0.4
Wholesale land use (%)	1.0	NA	1.3	0.7	1.0	0.2
Service land use (%)	0.4	NA	1.3	0.2	1.8	0.2
Public land use (%)	6.4	NA	4.9	6.0	2.8	2.7
Vacant and agricultural land use (%)	65.8	NA	71.0	61.1	71.3	81.2

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TABLE 3
PERCENT AUTO-DRIVER TRIPS BY RESIDENTS OF INTERNAL AREA, SHOWING
O-D SURVEY RECORDED PURPOSE OF TRIP

From	To	(1) Work	(2) Busi- ness	(3) Medical- Dental	(4) School	(5) Social Recrea- tion	(6) Change Travel Mode	(7) Eat Meal	(8) Shop- ping	(9) Home	Total
Work	(1)	3.51	0.86	0.07	0.18	0.83	0.03	3.66	1.13	12.34	22.61
Business	(2)	0.92	1.27	0.04	0.07	0.55	0.01	0.08	1.04	2.61	6.59
Medical- Dental	(3)	0.04	0.04	0.01	0.01	0.07	0	0.01	0.18	0.41	0.77
School	(4)	0.61	0.11	0.03	0.23	0.33	0	0.36	0.21	2.64	4.52
Social Recreation	(5)	0.59	0.35	0.04	0.10	2.11	0.02	0.14	1.03	7.97	12.35
Change Travel Mode	(6)	0.04	0.01	0.01	0	0.03	0	0.01	0.04	0.14	0.28
Eat Meal	(7)	3.43	0.10	0.02	0.30	0.20	0	0.01	0.15	0.49	4.70
Shopping	(8)	0.46	0.66	0.04	0.14	0.90	0.01	0.16	2.37	8.16	12.90
Home	(9)	13.19	3.12	0.54	3.54	7.48	0.18	0.48	6.72	0.01	35.26
Total		22.79	6.52	0.80	4.57	12.50	0.25	4.91	12.87	34.77	

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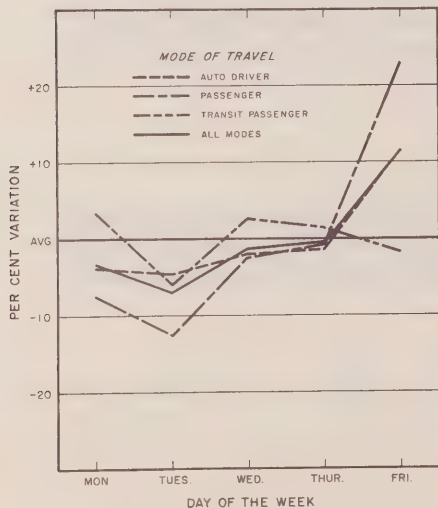


Figure 1. Daily variation of total internal person trips by mode of travel.

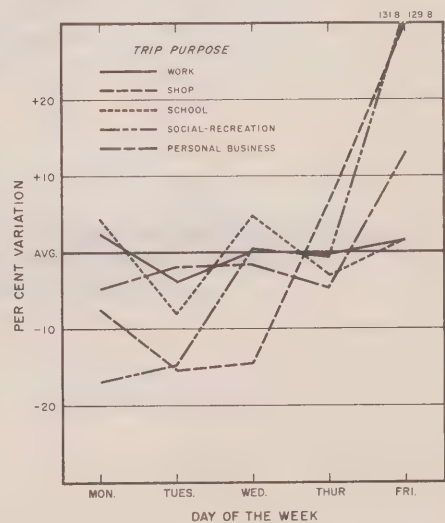
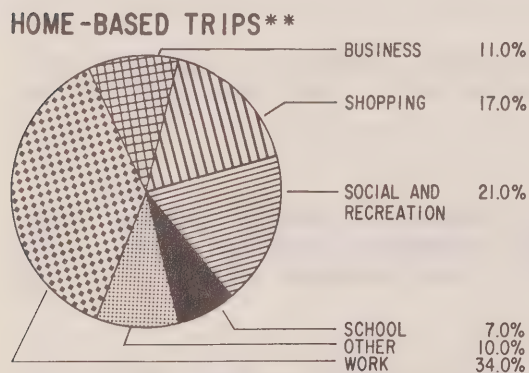


Figure 2. Daily variation of total internal person trips by trip purpose.

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SOURCE: * 1966 TRANSIT FACT BOOK, AMERICAN TRANSIT ASSOCIATION

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Figure 3. Urban transport, by mode and purpose.

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HOUSE-HOLD CHARACTERISTICS	ENVIRONMENTAL CHARACTERISTICS		
	Low	Medium	High
Low-Low	(1)*	(2)	(3)
High-Low	(4)	(5)	(6)
Low-Medium	(7)	(8)	(9)
High-Medium	(10)	(11)	(12)
Low-High	(13)	(14)	(15)
High-High	(16)	(17)	(18)

(CELL NUMBER)*

Source: Puget Sound Regional Transportation Study (PSRTS)

Figure 5. Rank classification matrix.

HOUSE-HOLD CHARACTERISTICS	ENVIRONMENTAL CHARACTERISTICS		
	Low	Medium	High
Low-Low	—	2.88	3.19
High-Low	5.51	6.03	5.29
Low-Medium	7.57	6.94	6.26
High-Medium	7.96	7.53	6.84
Low-High	8.47	8.38	7.79
High-High	9.08	9.54	—

Source: Puget Sound Regional Transportation Study (PSRTS)

Figure 6. Rank classification matrix, average person trips per household.

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136. Wynn, F. Houston. "Studies of Trip Generation in the Nation's Capital, 1956-58", Highway Research Bulletin 230, January 1959.
See Appendix C-5.
137. Wynn, F. Houston. "Who Makes the Trips? Notes on an Exploratory Investigation of One-Worker Households in Chattanooga", Highway Research Record Number 75, 1964.

TABLE 1
ONE-WORKER HOUSEHOLDS

No. in Household	No. Cars Owned	Daily Trips Generated in Household by			
		Workers	Nonworkers	Total	% by Worker
1	0	2.54	—	2.54	100.0
	1	3.95	—	3.95	100.0
	2	—	—	—	—
2	0	2.69	1.77	4.46	60.3
	1	5.55	3.04	8.59	64.7
	2	7.15	3.40	10.55	67.7
3	0	3.07	3.55	6.62	46.4
	1	6.15	5.11	11.26	54.7
	2	8.62	4.18	12.80	67.3
4	0	2.75	3.67	6.42	42.9
	1	6.70	4.87	11.57	57.9
	2	9.05	5.47	14.52	62.3
5	0	3.07	5.27	8.32	36.9
	1	6.70	6.40	13.10	51.2
	2	9.65	6.11	15.76	61.2

138. Wynn, F. Houston and Eric C. Linder. "Tests of Interactance Formulas Derived From O-D Data", Highway Research Board Bulletin 253, January 1960.
139. Zahavi, Yacov. "Splitting the modal split", Traffic Engineering and Control, February 1969.

APPENDIX G-2
TRANSPORTATION STUDIES

140. A Comprehensive Traffic and Transportation Study for the City of Barrie 1961-1983, prepared for the City of Barrie by Laughlin, Wyllie & Ufnal, Consulting Engineers in association with H. M. Edwards, Traffic Consultant, 1963.

Social Parameters

Study Area	Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
	21,700			3.5	.28

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
1.8	6.3	

Percent of Total Internal Trips to Destination Purposes

Purpose of Destination					Social	
Home	Work	Business	Shop	School	Recreational	Other
41.7	20.4	6.9	9.4	0.7	20.9	

See Appendix C-16

141. Traffic Planning Report for the City of Belleville, prepared by De Leuw, Cather & Company of Canada Limited, October 1961.
142. The Future of Downtown Calgary, prepared for the Planning Advisory Committee and Board of Commissioners of the City of Calgary by the City Planning Department in association with A. M. Voorhees and Associates, Simpson & Curtin, Affleck, Desbarats, Dimakopoulos, Lebensold & Sise.
143. Traffic Planning Report for the City of Chatham, prepared by De Leuw, Cather & Company of Canada Limited, March 1968.
144. Traffic Planning Report 1962-1985, prepared for the City of Cornwall by Damas and Smith Limited, Consulting Engineers, Toronto, London, Winnipeg.
145. Metropolitan Edmonton Transportation Survey Data Report, Interim Report No.4 Study Data, prepared by Stanley, Grimble & Roblin Limited in association with Barton, Aschman Association Inc, May 1963.
146. Metropolitan Edmonton Transportation Study, Volume 1, Requirements, prepared by the Edmonton District Planning Commission and Member Communities in cooperation with the Government of the Province of Alberta, June 1963.

147. Metropolitan Edmonton Transportation Study, Volume 2, Plan and Program, prepared by the Edmonton District Planning Commission and Member Communities in cooperation with the Government of the Province of Alberta, December 1963.
148. Guelph Area Transportation Study, prepared by Read, Voorhees & Associates Limited, December 1967.
149. Hamilton Area Transportation Plan, prepared for the Corporation of the City of Hamilton, Hamilton, Ontario by G. C. Parker & Parsons, Brincherhoff Limited, Consulting Engineers, Hamilton, Ontario, 1963.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
372,000	125,000	.335	3.72	0.24

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
2.10	7.80	

150. Kitchener-Waterloo Urban Traffic Study, prepared by Read, Voorhees & Associates Limited, November 1967.
151. London Area Traffic Plan 1959-1980, Project No.1856, prepared for the Corporation of the City of London, London, Ontario, by A. D. Margison and Associates Limited, Toronto, January 1960.
152. Traffic Planning Study Report, prepared for the Corporation of the City of London, Ontario by A. D. Margison and Associates Limited, April 1966.
153. Traffic Study, Volume I, Text-Tables-Figures, prepared for the Corporation of the City of Niagara Falls by H. G. Acres & Company Limited, Niagara Falls, Canada, July 1963.
154. Traffic Study, Volume II, Plates-Appendices, prepared for the Corporation of the City of Niagara Falls by H. G. Acres & Company Limited, Niagara Falls, Canada, July 1963.

155. Ottawa-Hull Area Transportation Study, prepared for the Provinces of Ontario and Quebec by De Leuw, Cather & Company of Canada Limited in association with A. M. Voorhees & Associates Inc., Traffic Consultants and Mr. W. E. P. Duncan, Transit Consultant, 1965.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
497,000	172,000	.345		.27

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
1.70		

Percent of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
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156. Plan de Circulation et de Transport Region Metropolitan de Quebec, Volume I, Les Enquetes, prepared for la Commission d'Amenagement de Quebec by Vandry & Jobin and De Leuw, Cather & Assoc., Consulting Engineers, in association with the City of Quebec and the municipalities of the region, 1967.
157. St. Catharines Area Transportation Study, prepared for the Corporation of the City of St. Catharines, Ontario, September 1965.
158. Central Area Transportation Study of Metropolitan Toronto, prepared by Read, Voorhees & Associates Limited in association with Alan M. Voorhees & Associates, Inc., March 1968.

159. The Metropolitan Toronto Transportation Plan, prepared by the Metropolitan Toronto Planning Board, December 1964.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
2,820,000				

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
1.40	5.42	

Percent of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other

160. Metropolitan Toronto and Region Transportation Study, the Three-Way Modal Split Analysis, prepared for the Metropolitan Toronto and Region Transportation Study by Traffic Research Corporation Limited, April 1965.

161. Metropolitan Toronto and Region Transportation Study, an Analysis Report on the 1964 Home Interview Survey, prepared for the Metropolitan Toronto and Region Transportation Study by Traffic Research Corporation Limited, March 1965.
162. Winnipeg Area Transportation Study, Volume One, Base Conditions, prepared for the Council of the Metropolitan Corporation of Greater Winnipeg by the Streets and Transit Division, February 1966.
163. Winnipeg Area Transportation Study, Volume Two, Travel Analysis, prepared for the Council of the Metropolitan Corporation of Greater Winnipeg by the Streets and Transit Division, July 1966.
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164. Report on Phase I of the Transportation Study for Ames, Iowa, prepared by De Leuw, Cather & Company, Chicago, Illinois, September 1967.

165. Baltimore Metropolitan Area Transportation Study, Volume 1, Findings and Recommendations, prepared for the Maryland State Roads Commission in cooperation with the U.S. Department of Commerce, Bureau of Public Roads by Wilbur Smith and Associates.

Social Parameters

Study Area	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
1,608,000	602,000	.375	3.30	0.28

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
2.13	7.10	

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other

166. Baltimore Metropolitan Area Transportation Study, Volume II, Statistical Data, prepared for the Maryland State Roads Commission in cooperation with the U.S. Department of Commerce, Bureau of Roads by Wilbur Smith and Associates.

167. Comprehensive Traffic and Transportation Inventory, prepared for the Commonwealth of Massachusetts, Boston Regional Planning Project, by Wilbur Smith and Associates in cooperation with the Urban Renewal Administration of the Housing and Home Finance Agency and the United States Department of Commerce, Bureau of Public Roads, September 1965.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
3,584,000	1,300,000	.360	3.26	0.30

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
2.22	7.30	

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
36.0	18.3	7.7	10.9	5.1	9.7	12.3

168. Billings Metropolitan Area Transportation Study, Basic Data on Parking, prepared for the State Highway Commission of the State of Montana and the City of Billings in cooperation with the U.S. Department of Commerce, Bureau of Public Roads, by De Leuw, Cather & Company, Chicago, Illinois, March 1962.

169. Billings Metropolitan Area Transportation Study, Basic Data on Traffic - 1961, prepared for the State Highway Co. Commission of the State of Montana and the City of Billings in co-operations with the U.S.Department of Commerce, Bureau of Public Roads, by De Leuw, Cather & Company, Chicago, Illinois, February, 1963.

Social Parameters

Study Area	Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
	61,400			3.34	0.39

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trip
3.60	11.9	10.5

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other

170. Billings Metropolitan Area Transportation Study, Summary
Report, prepared for the State Highway Commission of the State
of Montana and the City of Billings in cooperation with the
U.S. Department of Commerce, Bureau of Public Roads, by De Leuw,
Cather & Company, Chicago, Illinois, 1964.
171. Transportation Plan, Billings Metropolitan Area Transportation
Study, prepared for the State Highway Commission of the State
of Montana and the City of Billings in cooperation with the
U.S. Department of Commerce, Bureau of Public Roads, by De
Leuw, Cather & Company, Chicago, Illinois, February, 1964.

172. Chicago Area Transportation Study, Volume I, Survey Findings, prepared for the State of Illinois, County of Cook, City of Chicago, in cooperation with the U.S. Department of Commerce, Bureau of Public Roads, December 1959.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
5,170,000	2,549,000	.490	3.10	0.26

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.97	5.85	

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
43.5	20.5	12.4	5.5	1.9	12.8	3.4

173. Long-Range Transportation Plan for the Central Business District, Dallas, Texas, prepared for the City of Dallas by De Leuw, Cather & Company, Chicago, Illinois, July 1965.

174. Report on the Detroit Metropolitan Area Traffic Study, Part 1, Data Summary and Interpretation, prepared for the Michigan State Highway Department in cooperation with the United States Department of Commerce, Bureau of Public Roads, July 1955.

Social Parameters

Study Area	Population	Employment	Employment Per Population	Persons Per Dwelling Unit	Autos Per Person
	2,969,000			3.31	0.28

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.77	6.42	9.0

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
39.5	23.5	6.9	8.2	3.0	12.1	6.8

175. Report on the Detroit Metropolitan Area Traffic Study, Part II Future Traffic and a Long-Range Expressway Plan, prepared for the Michigan State Highway Department in cooperation with the U.S. Department of Commerce, Bureau of Public Roads, by a Policy Committee, J. Carl McMonagle, Michigan State Highway Department, Chairman, March 1956.

176. Erie Area Transportation Study, Volume 1, 1962 Traffic Pat-
terns, prepared for the City Planning Commission of Erie,
Pennsylvania by the Commonwealth of Pennsylvania in coopera-
tion with U.S.Department of Commerce, Bureau of Public Roads
and the U.S.Housing and Home Finance Agency, November 1963.

Social Parameters

Study Area	Employment	Employment Per Population	Persons Per Unit	Autos Per Person
Population	Employment	Population	Unit	Person
178,000	65,000	.365		0.31

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.96		

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
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See Appendix D-1

177. Erie Area Transportation Study, Volume II, Analysis and Fore-
casts, prepared for the Commonwealth of Pennsylvania in co-
operation with the U.S.Department of Commerce, Bureau of
Public Roads and the U.S. Housing and Home Finance Agency,
October 1964.

178. LaSalle County Planning and Transportation Study, Present Travel and Forecasting Procedures, prepared for the State of Illinois, Department of Public Works and Buildings, Division of Highways in cooperation with the LaSalle County Board of Supervisors by De Leuw, Cather & Company, Chicago, Illinois, November 1966.
179. Madison Area Transportation Study, Technical Report No. 9, Origin and Destination Survey Table Supplement, prepared for the Technical Coordinating Committee by the State Highway Commission of Wisconsin, 1962.

Social Parameters

Study Area	Employment	Employment Per Population	Persons Per Unit	Autos Per Person
169,200	58,900	.350	3.1	0.32

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
2.25	7.08	.10

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
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180. Milwaukee Metropolitan Area Transportation Study, Guide Lines to Technical Procedures and Study Organizations, prepared for the Milwaukee County Board of Supervisors by De Leuw, Cather and Company, Chicago, Illinois, January 1962.
181. Newark Transportation Study, prepared for the New Jersey State Highway Department in cooperation with the Bureau of Public Roads, U.S. Department of Commerce by Edwards and Kelcey, Inc., in association with De Leuw, Cather & Company 1961.

182. Pittsburgh Area Transportation Study, Volume I, Study Findings,
prepared for the Commonwealth of Pennsylvania in cooperation
with U.S.Department of Commerce, Bureau of Roads, November
1961.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Unit	Autos Per Person
1,472,000	555,000	.378	3.26	.27

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.63	5.10	.10

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
43.4	21.0	13.5	8.4	5.8	7.9	-

See Appendices C-16 and E-2

183. Penn-Jersey Transportation Study, Volume I, prepared for the Commonwealth of Pennsylvania and the State of New Jersey in cooperation with the U.S.Department of Commerce, Bureau of Public Roads.
184. The Federal Hill Area, Providence, Rhode Island, prepared for the State of Rhode Island, Department of Public Works in cooperation with the U.S.Department of Commerce, Bureau of Public Roads by De Leuw, Cather & Company, May 1964.
185. Pleasant Hill Traffic Study, prepared for the City Council of the City of Pleasant Hill, California by De Leuw, Cather & Company, San Francisco, California, September 1969.
186. Puget Sound Regional Transportation Study, Summary Report, prepared for the Puget Sound Governmental Conference, State of Washington in cooperation with the U.S.Department of Transportation and the U.S.Department of Housing and Urban Development.
187. Peninsula Area Transportation Study, Commonwealth of Virginia Survey Findings and Data Projections, prepared by De Leuw, Cather & Associates, September 1966.
188. Preliminary Geometric Design and Location of Portions of Interstate Routes 1 and 2, Salt Lake City, Utah, prepared by De Leuw, Cather & Company, San Francisco, California, March 1958.

189. St. Louis Metropolitan Area Transportation Study 1957-1970-1980,
prepared by W. C. Gilman & Company.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Unit	Autos Per Person
2,075,000	851,000	.41	3.12	.29

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.94	3.76	.11

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
40.5	20.8	6.0	10.5	3.0	12.3	6.9

190. Mass Transportation Survey, Traffic Engineering Study, prepared for the National Capital Region by Wilbur Smith and Associates, 1958.

Social Parameters

Study Area Population	Employment	Employment Per Population	Persons Per Unit	Autos Per Person
1,568,000	816,000	.520	3.02	.27

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.67	5.05	.08

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
41.7	23.4	4.7	8.2	4.4	7.1	10.5

191. Mass Transportation Survey National Capital Region, Civil Engineering Report, prepared for the National Capital Planning Commission, National Capital Regional Planning Council by De Leuw, Cather & Company, Chicago, Illinois, January 1959.

192. Worcester Urbanized Area Transportation Study, Gravity Model Development and Calibration, prepared for the Massachusetts Department of Public Works in cooperation with the U.S. Department of Commerce, Bureau of Public Roads by De Leuw, Cather & Company, January 1967.

193. Bibliography of Existing Data for Core Area Transportation Study Worcester Redevelopment Authority, prepared by De Leuw, Cather & Company, December 1964.

194. Metropolitan Adelaide Transportation Study, Report on Basic Data for Transportation Planning, prepared for the Joint Steering Committee by De Leuw, Cather & Company, in association with Rankine & Hill, Sydney, Australia, and A. M. Voorhees & Associates, Washington, D.C., October 1966.

Social Parameters

Study Area	Employment	Employment Per Population	Persons Per Unit	Autos Per Person
746,000	296,000	.40	3.47	0.27

Trip Generation Factors

Internal Person Trips Per Resident	Internal Person Trips Per Dwelling Unit	Truck Trips Per Person Trips
1.92	6.50	.135

Percentage of Total Internal Trips to Destination Purposes

Purpose of Destination

Home	Work	Business	Shop	School	Social Recreational	Other
39.5	28.3	9.0	7.9	5.1	10.2	-

195. Metropolitan Adelaide Transportation Study, prepared by De Leuw, Cather and Company in association with Rankine and Hill and Alan M. Voorhees and Associates, Inc., June 1968.
196. Comprehensive Transportation Plan, prepared for the Auckland Regional Authority by De Leuw, Cather & Company, October 1965.
197. Canberra Area Transportation Study Engineering Report, prepared for the National Capital Development Commission of Canberra by Rankine & Hill in association with De Leuw, Cather & Company, August 1963.
198. Report of the Probe Study, Cardiff Development and Transportation Study, prepared by Colin Buchanan and Partners, London in association with Messrs. W. S. Atkins and Partners, Epsom and Economic Consultants Limited, London, England, April 1966.
199. The Comprehensive Transportation Study for Dunedin, prepared by De Leuw, Cather & Company in association with Rankine & Hill, December 1964.
200. Durban Area Transportation, Volume I, Survey Findings and Data Projections, prepared by De Leuw, Cather & Associates, 1968.

201. London Traffic Survey, Volume I, Existing Traffic and Travel Characteristics in Greater London, prepared for the London County Council in conjunction with the Ministry of Transport by Freeman, Fox and Partners, London, England, in association with Engineering Service Corporation, Los Angeles, California and Wilbur Smith and Associates, New Haven, Connecticut, July 1964.
202. Report on Public Transport and the Planning Process for Perth, Western Australia, Australia, prepared for Main Roads Department, Western Australia by De Leuw, Cather & Company, July 1964.
203. Sydney-Area Origin-Destination Survey, Sydney, Australia, prepared by De Leuw, Cather & Company, San Francisco, California in association with Rankine & Hill, North Sydney, New South Wales, Australia, December 1960.
204. Basic Data on Public and Private Transport Travel in the Eastern and Southeastern Suburbs, Sydney, Australia, prepared for the Ministry of Transport, New South Wales by De Leuw, Cather & Company in association with Rankine & Hill, May 1963.
205. Comprehensive Transportation Plan for Wellington, New Zealand, prepared by De Leuw, Cather & Company in association with Rankine & Hill, August 1963.

